Wind Energy

Is There an Economy of Scale in Alaska?

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Executive Summary

The purpose of this project is to show the cost relationship per kilowatt hour (kWh) between small scale (≤ 25kWh), medium scale (> 25 kWh and ≤ 100 kWh), and large scale (> 100kWh) wind turbines. Our analysis will compare the cost per kWh and identify the economy of scale between our custom small scale models to commercial models. The commercial models used for this project were installed by Golden Valley Electric Association (GVEA) at their Healy, Alaska wind farm. We requested their wind data, capital investment breakdown, and their operations and maintenance costs. This data will be compared to the costs and wind data associated with our custom built wind turbine.

Wind energy is dependent on one major variable, the wind. Regardless of the wind turbine size, wind speed, frequency, and duration will affect the efficiency of every wind turbine.

Commercial wind farms are new to Alaska. The first major wind power project in Alaska was in 1997 in Kotzebue. This wind farm, of 17 wind turbines, represents the first megawatt of wind power in Alaska. Installation and maintenance of these systems is more expensive in Alaska due to the states' remoteness. Small scale systems used in this study are custom built because small scale commercial systems are not "hardy" enough to withstand Alaska's harsh weather systems. Both medium and large scale systems, for this study, are commercially constructed systems that have been designed to withstand these harsh conditions

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Introduction

Alaska has many natural resources that has enabled the young state to develop a sustainable economy and trade internationally. There is more oil leaving the state than is being refined for local use. The cost of electricity is tied to the cost of shipping fuel oil from sources outside of the state; causing the cost to increase for the end user. Wind power is a renewable source of electricity that can last as long as the sun shines and the wind blows. However, there are many factors that can affect wind power cost effectiveness. Wind variability, capital costs, operations, and maintenance are big factors that affect cost efficiency. Starting with the first wind mill to the first wind turbine to current wind turbines many engineering and scientific modifications have taken place to maximize the efficiency of wind power production.

One method of producing cheap power in Alaska is to construct small scale homemade turbines. These have low initial costs and almost no operational costs. Large scale wind farms have substantial capital and operational costs. However, the large wind farms produce massive amounts of power compared to the small scale turbines; dispersing per kWh overhead. With the possibility of running out of fossil fuels in the future wind power is a way forward for Alaska to be energy dependent without oil. Now we must determine which type of turbine, location, and design to use in order to economically produce power with one of Earth's most powerful forces.

What causes the wind?

Winds are the motion of air about the earth caused by its rotation and by the uneven heating of the planet's surface by the sun. During the daytime, the air over the earth's crust partly absorbs the sun's energy, but a larger portion is reflected back, heating the atmosphere.[i] This happens because the warm soil heats the air above it and warm air is less dense than cool air; causing it to rise. Cool air flows in to take its place and is itself heated. The rising warm air eventually cools and falls back to earth, completing the convection cell. The cycle is repeated over and over again, rotating like the crankshaft in a car, as long as the solar engine driving it is in the sky.[ii] Local shoreline breezes are merely a displacement of warm bodies of air by cooler masses. At night the breezes are reversed, since water cools at a slower rate than land. Similar breezes are generated in valleys and on mountains as warmer air rises along the heated slopes. At night, the cooler, heavier air descends into the valleys (Figure 1)[i].

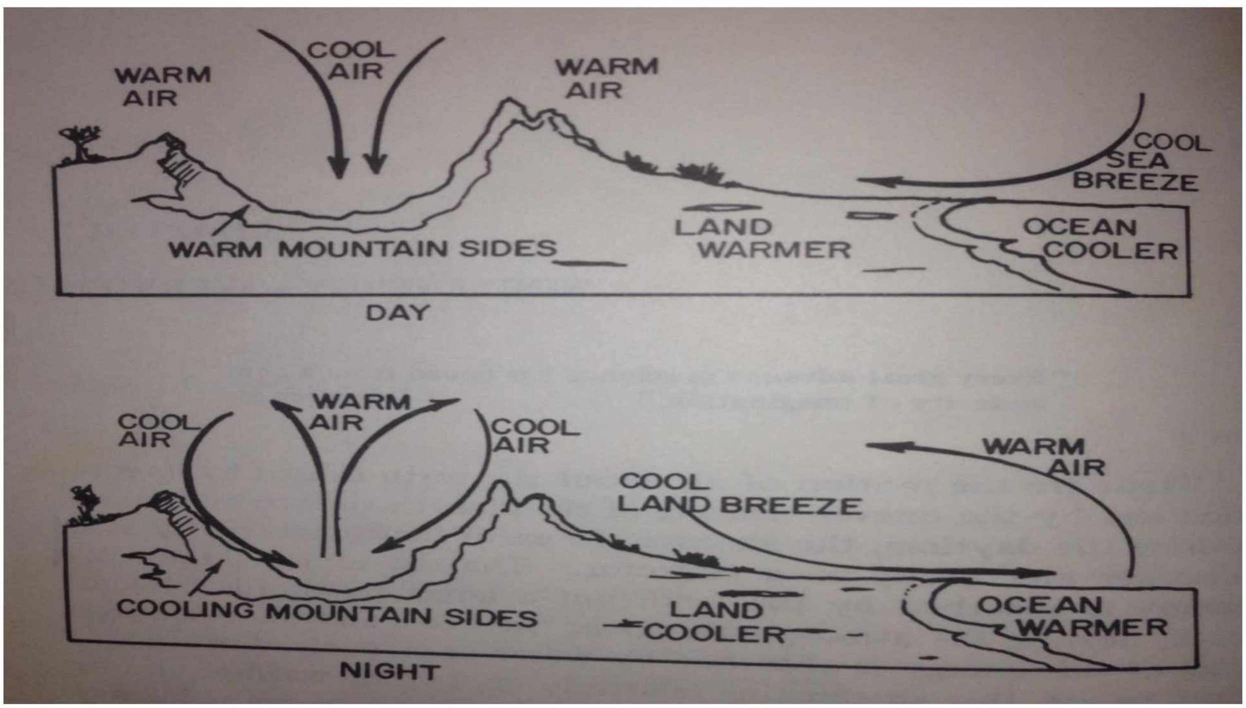


Figure 1, illustrates the generation of land and ocean wind formations (Source: Fundamentals of Wind Energy)

These winds are also affected by the earth's rotation about its axis and the sun. The moving colder air from the poles tends to twist toward the west because of its own inertia. The warm air from the equator tends to shift toward the east because of its inertia. The result is large counterclockwise circulation of air streams about low-pressure regions in the northern hemisphere and clockwise circulation in the southern hemisphere.

The seasonal changes in strength and direction of these winds result from the inclination of the earth's axis rotation at an angle of 23.5° to the axis rotation about the sun, causing variations of heat radiating to different areas of the planet (Figure 2). [i]

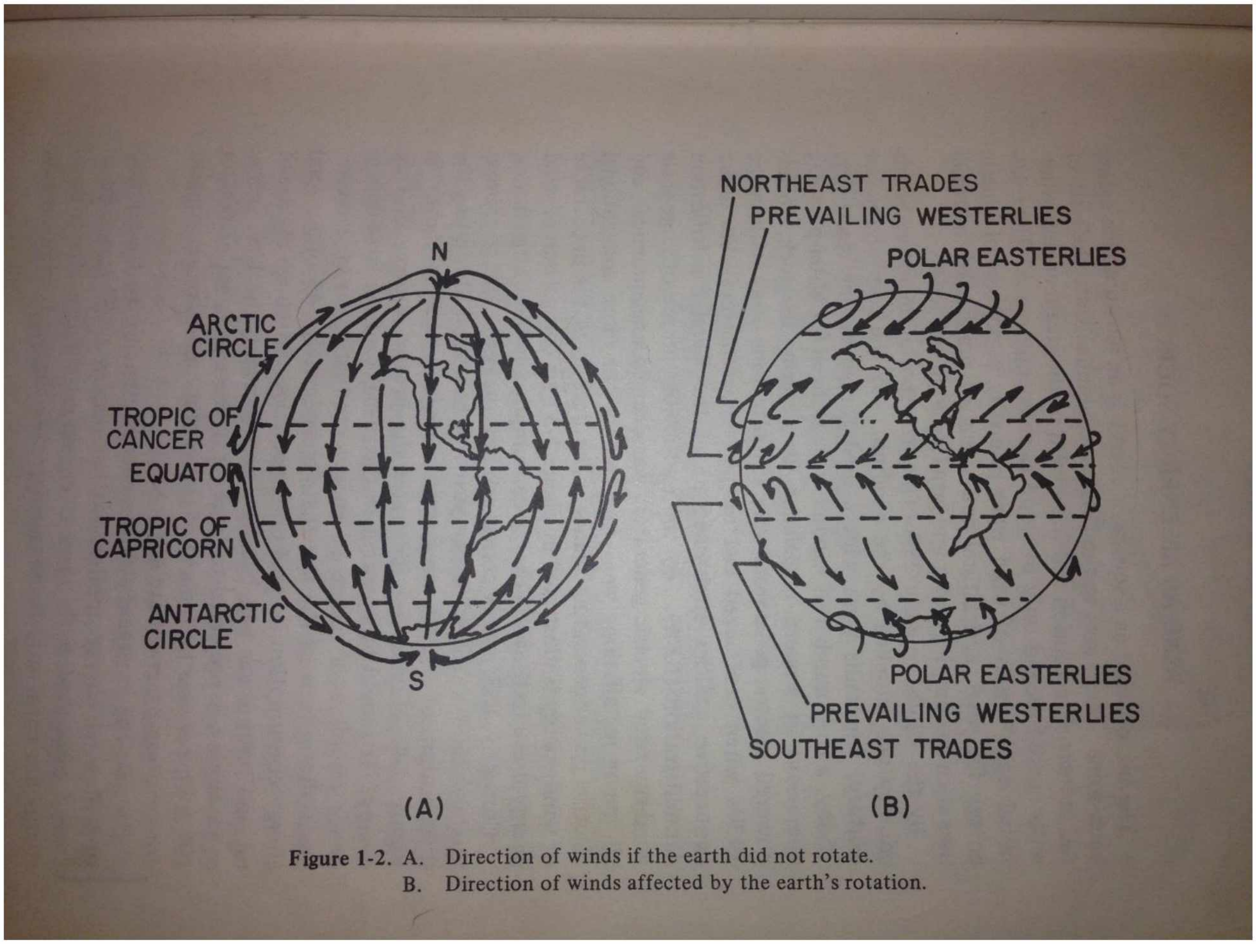


Figure 2, illustrates how the earth's rotation affects winds. (Source: Fundamentals of Wind Energy)

"Winds are also stronger and more frequent along the shores of big lakes and along the coasts because of differential heating between the land and the water. During the day, the sun warms the land much quicker than it does the surface of the water. (Water has a higher specific heat and can store more energy without change in temperature than can soil.) The air above the land is once again warmed and rises. Cool air flows landward, replacing warm air, creating a large convection cell. At night the flow reverses as the land cools more quickly than the water. This will be discussed later in the paper due to the amount of coastal land in Alaska." [ii]

The History of Wind Power

In 1860 Abraham Lincoln said “Of all the forces of nature, I should think the wind contains the largest amount of motive power … Take any given space of the earth’s surface, for instance, Illinois, and all the power exerted by all the men, beasts, running water and steam over and upon it shall not equal the 100th part of what is exerted by the blowing of the wind over and upon the same place. And yet it has not, so far in the world’s history, become properly valued as motive power. It is applied extensively and advantageously to sail vessels in navigation. Add to this a few windmills and pumps and you have about all. As yet the wind is an untamed, unharnessed force, and quite possibly one of the greatest discoveries hereafter to be made will be the taming and harnessing of it.” [vi]

“The existence of the sailing ship, as proven by Egyptian records and Cretan seals, indicates that for four thousand years some members of mankind have been experienced in handling quite substantial units of wind power.” [iii] The use of wind as a source of energy is an old approach dating back about 2000 years to the Persian windmills. “Until the birth of the industrial revolution and the advent of the steam engine, windmills ranked second only to wood as an energy source.” [i] The traditional applications of wind were primarily as sources of kinetic energy for rural, agricultural, and a limited number of industrial uses such as pumping water and grinding grain and feed. By the 1850s, roughly 25% of non-transportation energy in this country was supplied by the windmill. [i]

In 1865 British scientists discovered that their coal deposits were finite and determined that without coal they would be thrust into the poverty of the past. This coupled with the invention of Joseph W Swann’s lamp and Thomas A Edison’s lightbulb there became a need and a use for electricity. William Thompson (Lord Kelvin), the eminent physicist and electrician, was the first to propose the use of the windmill for electricity production in 1881. In America, Alfred Wolff advocated their use in 1885, and Joseph J Freely and George, E McQuestion set up small scale, wind powered electricity generating plants during the late 1880’s. These and other earlier trials concerned direct current (D.C.) generation.[iv]

One of the most prominent pioneers to take advantage of the new light was Charles F Brush of Cleveland, Ohio. Around 1890, he erected a windmill to provide the power source for experiments as well as lighting his huge mansion. The rotor was an annular sail with fixed wooden blades that were 56 foot in diameter and a 60 foot long rear vane (Figure 3). This wind mill charged 408 secondary battery cells which in turn powered 350 incandescent light bulbs on his estate. [iv]

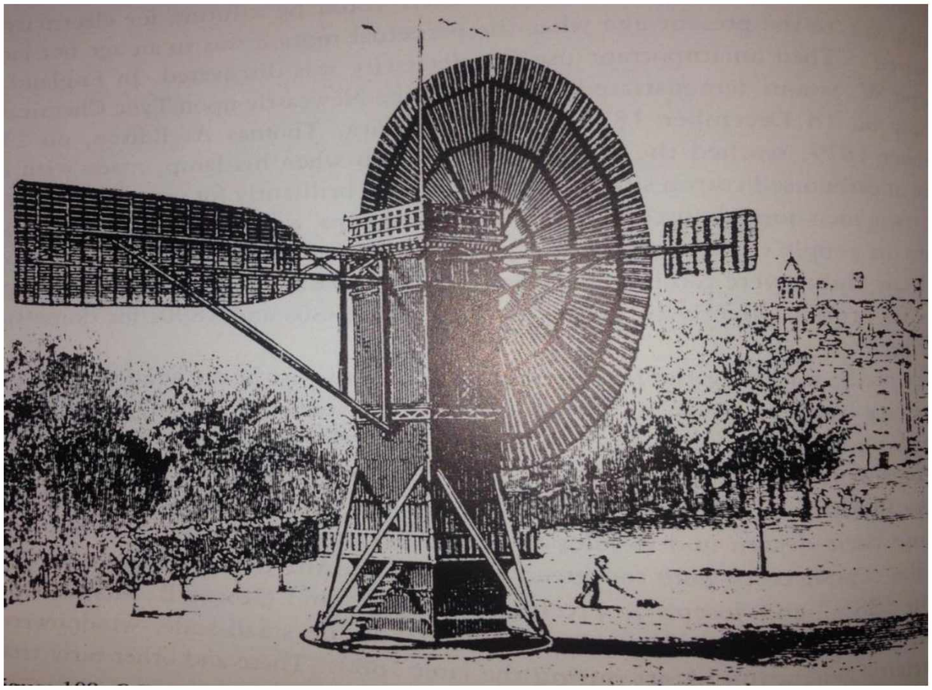


Figure 3, C.F. Brush's huge experimental electricity-generating windmill at Cleveland, Ohio in the 1890's. (Source: Power from Wind)

Professor Poul La Cour, of Denmark, was a pioneer in the field of aerodynamics and is known for his development of windmills for electricity generation. With his wind tunnel experiments, he developed the theory for the ideal windmill blade profile and discovered that the airflow behind the blade was just as important as the wind's forward pressure. Poul la Cour also studied the potential of storing wind energy in hydrogen and oxygen by electrolysis. [v]

Figure 4, Poul la Cour's test turbines in Askov, Denmark 1897. (Source: Power from Wind)

“La Cour was the first person to undertake systematic investigations on wind power for electric generation for, in the physical laboratory, he carried out tests on different shapes of windmill sails with wind from a propeller. He did not change the basic design of traditional sails and outlined the pattern he conceived for his ideal mill:

(a) It should have four sails whose surface, particularly at the tips, should present the least resistance to rotation.

(b) The sails should be parallel-sided and of width one-fifth to one quarter of the length.

(c) The sail surface should begin at the distance of about one-quarter of the length from the axis of rotation and the sail should occupy the remaining three-quarters.

(d) The sail profile near the tip should be straight but bent convex to the wind at one-sixth to one-quarter of the width from the front edge.

(e) The weather angle should be 10° at the tip and should increase regularly to be 15° two-thirds of the length from the axis and 20° at one-third.

(f) The tip speed should be 2.4 times the speed of the wind from which the maximum amount of energy is to be extracted; it will thus be generally 6 or perhaps 5 m/sec. (20 to 16 feet)” [iv] Many of these experimental findings or modifications of these findings are still used today in wind turbine design.

By the turn of the 20th century, windmills were widely used for generating electricity. Throughout the beginning of the 20th century many design modifications occurred to increase the efficiency of wind power production. Some of the modifications were energy storage, location of generating equipment on a tower, and methods to connect the turbines to a grid system. Some scientists and engineers agree that the most important turbine erected was on Grandpa’s Knob in Vermont by Palmer Cosslett Putnam. After running his turbine on a grid system from 1941 through 1945 his turbine fell apart. One of the turbine blades snapped off after accumulated stress over four years of operation. Putnam concluded that “The state of our knowledge concerning the habit of wind in mountainous country was meager and uncertain.” He redesigned his tower using steel and erected a 185 foot turbine on top of Grandpa’s Knob. The purpose of this tower, named the “Christmas Tree”, was to measure the vertical distribution of the wind above a bare summit as well as its effects on the contour of the mountain. This experiment led to how wind turbines are placed on a terrain feature to maximize its efficiency. [iv]

His experiments enabled us to understand mountain-valley breezes and how the wind accelerates as it passes over a ridge. The Mountain-valley breeze is a local wind caused by differential heating. These occur when the prevailing wind over mountainous terrain is weak and there is measurable heating and cooling. Typically these winds are more prevalent in the summer when solar radiation is the strongest. The sun heats the floor and sides of the valley. Then the warm air rises up the slopes and moves down stream. Cooler air is drawn upward from the plain below, causing the valley breeze. At night, the cool air falls down the slopes into the valley and is channeled to the plains. Mountain-valley breezes can be stronger when they flow the same way as the prevailing winds (Figure 5). [ii]

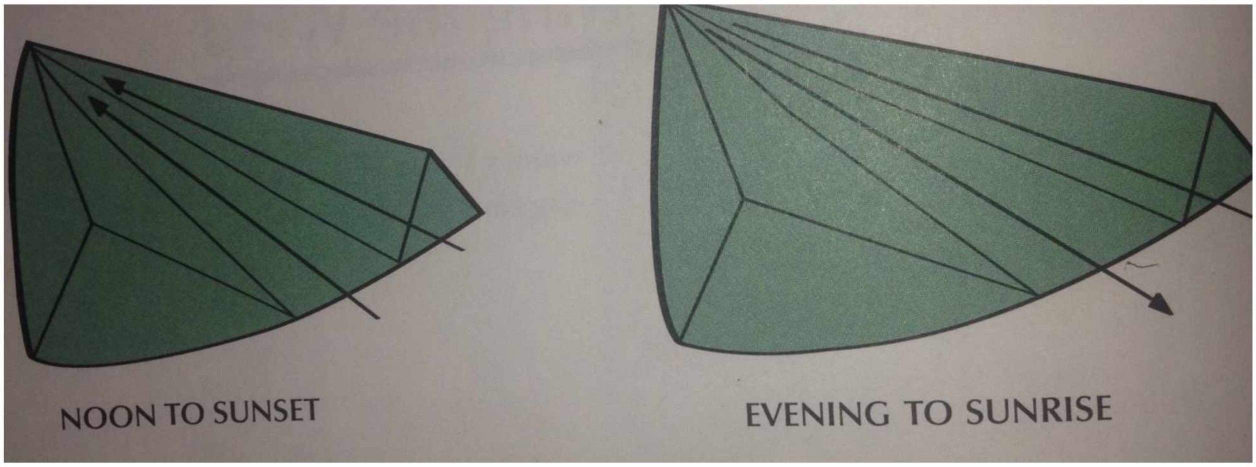


Figure 5, Mountain-valley winds. (Source: Wind Power)

Long ridges across the path of wind enhance the wind flow over the summit. Wind speeds can double as the wind accelerates up the slope to the summit. Wind speeds are typically lower at the foot of the ridge (Figure 6). [ii]

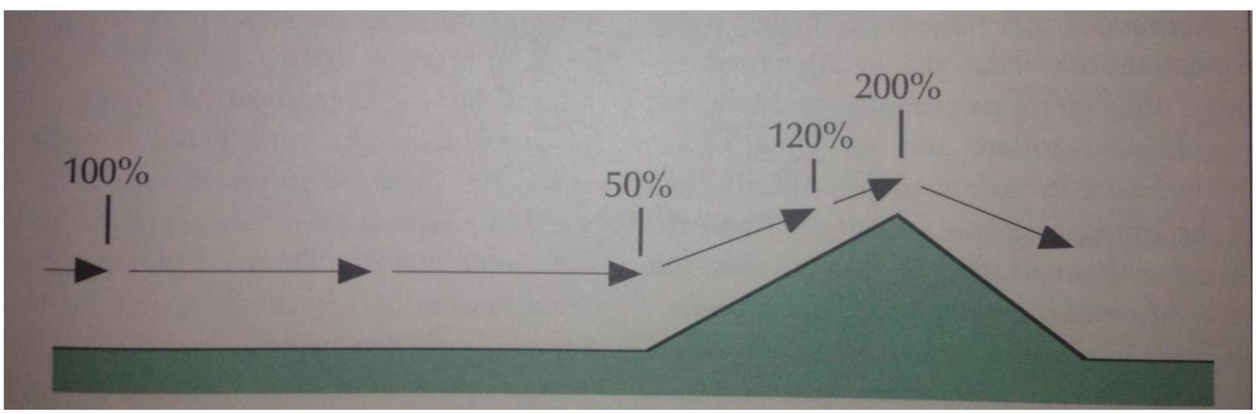


Figure 6, Increase in wind speed over a ridge. (Source: Wind Power)

After World War II many more prototypes were designed and installed throughout the world. Many valuable lessons were learned but interest plummeted due to the availability of cheap oil and the forecast of abundant and cheap nuclear power. This caused the young wind energy programs to be abruptly halted in the 1960s. Wind power did not become popular again until the price of oil dramatically increased during the oil crisis of 1973. Even though the price of oil is currently relatively low, modern technology has made wind power more competitive. [iv]

Wind Power in Alaska

Alaska has just recently joined the lower 48 states in finding new ways to use wind power for the electrical grid. The projects first started in the remote communities but expanded to the primary electrical grid. Wind distribution throughout the state is not consistent. Interior Alaska, for the most part, has very low wind production. This increases the cost of wind power for the interior because of the cost of infrastructure to transmit the produced electricity. Recently, Fire Island was going to double their production by installing more wind turbines. The Alaska infrastructure does not have the capacity to transmit the extra electricity unless the infrastructure is upgraded. According to an interview in the Daily Newsminer, the cost of the produced electricity would double by the time it reached interior Alaska. [ix] Appendix shows that the greatest wind production in Alaska is along the coast, in the mountains, and the Aleutian Island chain.

Currently, there are numerous wind energy projects throughout the state. A list is provided below of some of the current projects; according to the Alaska Renewable energy Project (REAP)

Chevak – In summer 2008, Alaska Village Electric Cooperative installed four 100 kW wind turbines in this class 6 wind resource location, providing an additional source of energy for the city's 938 residents. Currently, the city has a PCE rate of $0.28 /kWh and an Average Residential Rate of $0.48/kWh Since then, AVEC has also begun designing and constructing a secondary load to capture excess energy that will then provide heat for a water treatment plant and water storage tank.

Delta Junction – The 100-kW wind turbine was installed by Alaska Environmental Power and came online in October 2008 as the first of Golden Valley Electric Association's Renewable Resource Purchase Program installations. Units of this size can connect to the distribution system instead of a transmission system. In 2009, Alaska Environmental Power added a 900-kW turbine for a total of 1 MW and in 2010 announced plans to try to expand to 25 MW by installing 16 GE wind turbines. The turbines are located on a 320-acre site at Mile 1418 of the Alaska Highway, about three miles southeast of Delta Junction (population of 958).

Emmonak/Alakanuk- The Alaska Village Electric Cooperative began construction on sites in Emmonak and Alakanuk in 2011. To date, AVEC has erected and interconnected four turbines. The site is currently operational, running at a '16+ percent capacity factor for 2012 and displacing 6,465 gallons of diesel every year.

Eva Creek – Golden Valley Electric Association (GVEA) constructed a 24-megawatt wind farm in Eva Creek near Healy. The project includes 12 turbines at 1.5 MW each. This represents about 20 percent of GVEA's peak load. They began producing power in 2012.

Fire Island – In late September 2012, the Fire Island Wind project was officially in commission. Built by Cook Inlet Region Inc. (CIRI), this 11-turbine project has a 17.6-megawatt generation capacity and is expected to sell more than 50,000 MW-hours to Chugach Electric Association annually. The project will supply four percent of Chugach's energy needs (enough to power about 4,000 Southcentral homes) and offset up to .5 billion cubic feet (bcf) of natural gas consumption in Southcentral Alaska each year. Fire Island Wind, LLC will build additional project phases if additional buyers agree to purchase wind power. The full project is permitted to include up to 33 turbines with 52.8 MW total generation capacity

Gambell - Alaska Village Electric Cooperative has installed three 100-kW wind turbines in Gambell. The city's 681 residents currently have a PCE rate of $0.30/kWh and an Average Residential Rate of $.50/kWh. AVEC received additional funding to design and construct a secondary load to capture excess energy and provide heat for a water treatment plant and a drinking water storage tank.

Hooper Bay – Hooper Bay has three Northwind turbines that were installed in 2009 by the Alaska Village Electric Cooperative. The wind project produces approximately 66 kW of power and displaces 15,995 gallons of diesel every year. The city's 1,093 residents currently have a PCE rate of $.030/ kWh and an average residential rate of $0.50/ kWh.

Kasigluk – Kasigluk installed three Northwind 100-kW turbines in 2006 with a total generating capacity of 300 kW. Wind accounts for roughly 21 percent of total electrical generation. Total wind/diesel generating capacity is 1,624kW and the wind project displaces approximately 52,000 gallons of diesel. Power is provided to the community of Nunapitchuk through a distribution intertie. Nunapitchuk's 496 residents currently have a PCE rate of $0.31/kWh and an Average Residential Rate of $0.51/kWh.

Kodiak – The Kodiak Electrical Association installed three 1.5 MW turbines at Pillar Mountain in July 2009 at a cost of about $21.4 million. The installation, coupled with a hydro facility, at times allow the utility to provide 100 percent renewable power to Kodiak's 6,130 residents. In its first year, the turbines allowed the utility to cut diesel fuel use by 930,000 gallons, a savings of $2.3 million based on a diesel fuel price of $2.50 a gallon. Kodiak is now looking at installing an additional three turbines.

Kokhanok – This 180kW project, which involves two reconditioned V-17 Vestas turbines in class six wind resource locations, was completed in just six months. The system is connected to 336kWh of nominal battery storage, and the excess electricity produces heats the school's recirculation system. The turbines are integrated with advanced supervisory control and data acquisition (SCADA), allowing for remote control from Anchorage. A five-year operation, maintenance, and training commitment between Marsh Creek, LLC and the village of Kokhanok ensures long-term success, and the fully operational turbines have already significantly reduced village fuel consumption.

Kokhanok's 170 residents currently have a PCE rate of $0.52/kWh and an Average Residential Rate of $0.90/kWh.

Kongigank: In 2009, the Puvurnaq Power Company began construction of a 450 kW high-penetration wind system in Kongigank with multiple thermal loads in residences and the nearby school. Kongigank's 439 residents currently have a PCE rate of $0.31/kWh and an Average Residential Rate of $0.55/kWh. Projected is expected to be completed by 2013.

Kotzebue – Boasting the first wind program in the state of Alaska, Kotzebue Electric Cooperative installed three 66-kW turbines in 1997. Another 7 were installed in 1999. Today the Kotzebue's wind farm has grown to 17 wind turbines and represents the first megawatt of wind power in Alaska. Additionally, the farm displaces 80,000 gallons of diesel every year. In 2011, Kotzebue Electric began installing 900kW wind turbines and a high storage flow battery to maximize use of excess wind energy. Kotzebue's 3,201 residents currently have a PCE rate of $ 0.26/kWh and an Average Residential Rate of $0.42/kWh. Kotzebue hopes to eventually install a total of 2.95 MW, enough to meet the electric demand of Kotzebue during peak load.

Kwigillingok- Kwigillingok began construction in 2010 and to date has erected two turbines. The entire system is projected to produce 450 kW. The entire integrated system will be commissioned by spring of 2013. Kwigillingok's 321 residents have a PCE rate of $0.32/kWh and an Average Residential Rate of $0.61/kWh.

Mekoryuk – Alaska Village Electric Cooperative's wind farm in Mekoryuk came online in November 2011. The wind project includes two Northwind 100 turbines and average displacement was estimated at 33,000 gallons per year. Mekoryuk's 191 residents currently have a PCE rate of $0.35/kWh and an Average Residential Rate of $0.56/kWh.

Nome – This 18 turbine wind farm capable of producing 1.2 MW of power came online in early 2009. Bering Straits Native Corp. and area village corporation Sitnasuak Native Corp. own the wind farm. The project produces about 10% of the electric load for Nome Joint Utilities. Nome Joint Utilities also has plans for a bigger wind farm that could generate up to 3 MW depending on wind conditions. Nome's 3.98 residents currently have a PCE rate of $0.15/kWh and an Average Residential Rate of $0.35/kWh.

Pillar Mountain- In 2009, Kodiak Electric Association (KEA) expanded their current wind farm from three to six GE 1.5 MW SLE turbines. The total nameplate capacity of the expanded system was set at 9. The project is projected to be fully online by late 2012.

Quinhagak – Alaska Village Electric Cooperative installed 3 Northwind 100 turbines in Quinhagak in 2010. This wind project displaces 37,536 gallons of diesel every year.

Quinhagak's 669 residents currently have a PCE of $0.33/kWh and an Average Residential Rate of $0.54/kWh.

Saint Paul Island – This high-penetration, no-storage, wind-diesel power system was installed by TDX Power and Northern Power Systems in 1998 to run an industrial facility and airport complex on the island of St. Paul. The 500 kW wind-diesel cogeneration system cost approximately $1.2 million. According to TDX, the system has eliminated $200,000 per year in utility electric charges and $50,000 per year in diesel heating fuel since its installation in 1999.

Sand Point- Coordinated by Aleutian Wind Energy, the Sand Point Wind Project began construction in 2009. To date turbines have been erected and set to produce 330 kW of power, thereby displacing 152,318 gallons of diesel every year. Sand Point's 976 residents currently have a PCE rate of $0.34/ kWh and an Average Residential Rate of 0.54/kWh.

Savoonga – Savoonga's two Northwind 100 wind turbines with a generating capacity of 200 kW came online in the fall of 2008 and are operated by Alaska Village Electric Cooperative. Total wind-diesel generating capacity is 1,870 kWh. Savoonga's 672 residents have a PCE rate of $0.27/kWh and an Average Residential Rate of $0.48/kWh.

Selawik – Selawik, the first integrated wind-diesel facility the Alaska Village Electric Cooperative built in 2002, has four AOC 65-kW turbines with a generating capacity of 260 kW combined with a diesel for a total generating capacity of 1,647 kW. In 2011, AVEC began looking into upgrading the facility, switching out old AOC turbines with newer model. Selawik 829 residents currently have a PCE rate of $0.35/kWh and an Average Residential Rate of $0.56/kWh.

Shaktoolik- The Alaska Village Electric Cooperative has begun installing two Northwind 100-kilowatt turbines, plus secondary heat loads, load controllers and new switchgear. The two Northwind Wind Turbines were fully commissioned, remotely monitored and controlled as of July 15, 2012. The newly up-graded AVEC power systems are fully functioning and operating according to design as of August 15, 2012. The project displaces 8,468 gallons of diesel every year. Shaktoolik's 251 residents currently have a PCE rate of $0.38/kWh and an Average Residential Rate of $0.59/kWh.

Toksook Bay – The wind-diesel power system at Toksook Bay includes three Northern Power Systems Northwind 100kW turbines, diesel engines, and a computer-controlled resistive heater supplying community heating loads. It serves approximately 1,160 people in the communities of Toksook Bay, Nightmute, and Tununak and offset around 46,000 gallons of diesel in its first year of operation (August 2007 – September 2008), about 22 percent of total consumption.

Unalakleet – Unalakleet installed six 100-kilowatt wind turbines that were commissioned in November 2009. As of November 2010, the system had produced 697,929 kWh of electricity, which is equivalent to $139,585 (based on $.20/kWh) or 53,686 gallons of diesel fuel. The city's 688 residents currently have a PCE rate of $0.18/kWh and an Average Residential Rate of $0.38 kWh.

Wales - Wales has two Atlantic Orient Corporation 65-kW turbines that are owned by Kotzebue Electric Association. They aren't fully operational but have provided valuable information related to wind-diesel integration. Wale's population of 145 currently has a PCE rate of $0.42/kWh and an Average Residential Rate of $0.63/kWh.

Buckland, Deering, Noorvik- The wind projects located in Buckland, Deering and Noorvik, are coordinated by Northwest Arctic Borough. This 800 kW capacity project began construction in 2010 and is projected to displace 54,560 gallons of diesel every year.

Deering- In 2012, Alaskan Energy Association accepted Deering's wind feasibility and the project is ready to progress with the conceptual design phase.

Egegik- Lake and Peninsula Borough has received a grant from the Renewable Energy Fund in 2013 for this Bristol Bay area wind project.

Kipnuk, Kongiganak, Kwigillingok, and Tuntatuliak - The Chaninik Wind Group is working to install 450 kW wind turbines in each of these locations. These high penetration smart grid turbines, which will allow excess wind energy to provide heat for homes, are currently under construction, with commissioning expected in September 2011.

Newton Peak- Located in Nome, this 2,970 kW capacity wind project is coordinated by Nome Joint Utility Systems and will be completed in 2013.

Pilot Point – The City of Pilot Point was recently awarded a grant to install a 300kW wind project near Point Pilot. The project is currently under construction.

Point Hope- In 2011, the North Slope Borough commenced final designs for a 300 kW wind project with associated integration components in Point Hope.

Port Heiden- Lake and Pen Borough proposed a design and construction project for a 330kW wind turbine in Port Heiden and has received funding from the Renewable Energy Fund in 2011.

Quinhagak- In 2008, the Alaska Village Electric Cooperative began completing the final design, permitting, construction, erection, start up and commissioning of three Northwind 100 wind turbines in Quinhagak. The turbines are currently up and working.

St. George- Coordinated by City of St. George, this wind diesel project began construction in 2013 and is set to serve the community of St. George in the Aleutians. St. George's 102 residents currently have a PCE rate of $0.48/kWh and an average residential rate of $0.64/kWh.

St. Mary's/ Pitka's Point- The Alaska Village Electric Company began work on this project's final design in 2012.

Tuntutuliak- The Alaska Energy Authority and the Tuntutuliak Community Services Association constructed a 450KW high penetration wind-diesel system that powers the town of Tuntutuliak. The $3.7 million project is using 3-phase power lines, variable speed controllers, and secondary loads to maximize use of the turbine.

Wainwright- The North Slope Borough commenced the final design phase in 2011 for the proposed 300 kW wind project with associated integration components in in Wainwright. [viii]

Wind vs. Other Energy Sources

Alaska has many renewable resources that can be used for energy. According to REAP no one renewable energy source is the better than another. Each resource is specific to a specific location capabilities and limitations. Table 1 provides a summary of Alaska's renewable energy resources. [x]

BIOMASS ENERGY: Comes from the burning of natural materials such as grains, plant waste, and animal matter.	**WIND ENERGY: Wind turbines capture the power of the wind and convert it into electricity.**
Alaska is rich with biomass resources from forests that need maintenance clearing to fish oil from the state's fishing industry.	Alaska has some of the best wind resources in the country. More than twenty of Alaska's communities currently use utility-scale wind turbines to generate electricity.
PROs: Using biomass fuel can reduce landfill waste, and most of these raw products can be replenished	PROs: Wind energy is a mature technology that is currently in use worldwide.
CONs: The burning of biomass fuels can release carbon dioxide	CONs: Wind power is intermittent and unpredictable on a daily basis
GEOTHERMAL ENERGY: Taps heat from the Earth's core to provide direct heat or electricity	**TIDAL ENERGY: Tidal and wave energy systems exploit the power of incoming and outgoing tides and ocean waves, utilizing turbines and newer emerging technology**
Alaska's Chena Hot Springs is home to the lowest temperature geothermal plant in the world	Alaska could become a leader in US tidal energy development. The Cook Inlet has a 30 foot tidal range, the second largest in North America
PROs: Geothermal plants produce far less carbon dioxide emissions than fossil fuel plants and can continuously produce power	PROs: Tides and waves are both consistent and predictable
CONs: Many geothermal sites in Alaska are located in remote, scarcely populated areas	CONs: The emerging technology is still being developed and any potential negative effects are not yet known.
HYDROELECTRIC ENERGY: Turbines harness the power of falling and flowing water.	**RIVER ENERGY: In-river hydrokinetic systems use turbines placed directly in the flow of a river to capture the moving water's power.**
Alaska currently uses hydroelectric power to power 21% of Alaska's electricity needs.	In Alaska, in-river hydrokinetic power could be a convenient, unobtrusive power source
PROs: Hydroelectric facilities produce no waste, no pollution, and few greenhouse gases. They are highly reliable and require low maintenance.	PROs: In-river systems are adaptable for more locations than traditional hydropower
CONs: Hydroelectric plants can be expensive to construct and potentially damaging to fish ecosystems and surrounding land areas.	CONs: These smaller systems create less power than other water energy sources, and the technology is still being developed
SOLAR ENERGY: Solar technologies convert the power of the sun's rays to electricity and heat.	
Alaska's short winter days have made utility scale solar projects uneconomical. But hundreds of solar power systems are in use in remote, off grid residential locations.	
PROs: Solar panels are quiet, clean, and can be installed in otherwise unused locations, such as rooftops.	
CONs: Solar panels can only produce maximum power in day-lit, sunny conditions.	

Table 1, Summary of Renewable Resources in Alaska (Source: Renewable Energy Alaska)

Wind and Solar power are the two renewable energy sources that are used the most. Installing a wind turbine is a bit more involved than installing solar panels, but they are still relatively easy to incorporate into your alternative energy system. The turbine needs to be mounted in an area free from obstructions to wind flow (nearby buildings, trees, etc.).Some smaller turbines can be mounted to the rooftop of your house, but vibrations from the turbine may be transferred to the frame of the building. Rooftop turbine mounts often come with rubber vibration dampers to minimize this problem. As a general rule however, the higher in the air you can get your wind turbine the more effective it will be, so independent, guyed towers are the recommended mounting system. The wide variety of available tower heights and styles makes it much more likely you will find a mounting kit to suit your needs.

When installing the controls and wiring of a wind generator, it is important to understand two fundamental differences between wind turbines and solar panels:

Solar panels are "passive" electricity producers. Even though the sun is shining, they only produce electricity when a charge is needed by the battery. Wind generators are "active" electricity producers. If the wind is blowing, they will produce current whether the battery bank needs the charge or not. In order to prevent damage to the wind turbine, all of the electricity it produces must be "used" in some way. When the system batteries need charging current, they provide an electrical load to use the wind turbine's electricity. If the batteries are fully charged, the turbine's output must be "diverted" to another electrical load. A load diverting charge controller regulates wind generator output so your batteries receive charging current when they need it, and any excess electricity generated by the wind turbine is diverted to an alternate load when the batteries are fully charged. Some wind turbines have charge control features built-in, diverting their own excess current and allowing it to dissipate as heat through the wind turbine housing. In most turbine systems however, the charge controller is an external unit, and while DC rectifiers are always included as part of a basic wind turbine package, the load diverting controller may not be. Some load-diverting charge controllers come with a heat-sink resistor to attach as the diversion load. When the batteries reach full charge, the load-diverting controller will simply send electricity to this resistor, where the energy will be released as heat. Some wind turbines have diversion features built into the turbine body itself, and the turbines outer shell acts as a heat sink for the excess power. Many charge controllers allow you to use the diverted current for other uses, such as running a water heating coil, a ventilating fan or a space heating system, making the wind generator an even more useful and efficient source of power. Once a load-diverting charge controller is attached between the wind turbine and the storage batteries, your electrical system can be connected to the batteries, either directly for a matching-voltage DC system, or through an inverter for an AC or mixed AC/DC system.

Wind generators are not as affected by Alaska's climate as solar panels. With the right site, you can have a steady wind flow all year, unlike our sunlight fluctuations. In general though, most sites will have more wind during the winter months. This is ideal if you have a solar/wind hybrid power system, as the wind turbine will perform best when the solar panels perform least and vice-versa. One possible problem with wind turbines is the remote possibility of the propeller icing up in winter. Of course if the propeller freezes in place, the turbine won't be of much use. However, if the wind generator is mounted in a clear location (without snow blowing off surrounding surfaces into the turbine) with fairly steady winter winds, the constant motion of the turbine should be sufficient to keep the propeller clear. However, to make up for the inconveniences, according to the Department of Energy's Energy Efficiency and Renewable Energy network (EREN), "Some wind turbines in Alaska produce more than their maximum rated power output because air becomes denser at lower temperatures. This effect can cause a 20% increase in maximum power output at -35degF." [xi]

Government Incentives

It is no secret that fossil fuels are a limited resource on this planet. The United States government and the State of Alaska have passed laws to incentivize the use of renewable and low pollutant energy sources. Some Federal incentives that are widely used in Alaska are the Renewable Energy Production Tax Credit (PTC), The Investment Tax Credit (ITC) and Clean Renewable Energy Bonds (CREB).

“The federal renewable electricity production tax credit is an inflation-adjusted per-kilowatt-hour tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. Originally enacted in 1992, the PTC has been renewed and expanded numerous times, most recently by the American Recovery and Reinvestment Act of 2009 (H.R. 1 Div. B, Section 1101 & 1102) in February 2009 (often referred to as "ARRA"), the American Taxpayer Relief Act of 2012 (H.R. 8, Sec. 407) in January 2013, and the Tax Increase Prevention Act of 2014 (H.R. 5771, Sec. 155) in December 2014.” [xvi]

“The internal revenue service enforces The Investment Tax Credit section 48. The ITC Section 48 allows project owners or investors to be eligible for Federal business energy investment tax credits for installing designated renewable energy generation equipment placed in service during the period 2006 through 2016. A tax credit is a dollar-for-dollar reduction in the income taxes that the person claiming the credit would otherwise have to pay the federal government. Section 48 provides an investment tax credit consisting of the "energy percentage" times the basis of energy property placed in service during the taxable year. Qualifying renewable energy projects are able to take advantage of investment-based credits up to 30% of eligible costs.” [xii]

“CREB may be used by certain entities (primarily in the public sector) to finance renewable energy projects. The list of qualifying technologies is generally the same as that used for the federal PTC. CREBs may be issued by electric cooperatives, government entities (states, cities, counties, territories, Indian tribal governments or any political subdivision thereof), and by certain lenders. The bondholder receives federal tax credits in lieu of a portion of the traditional bond interest, resulting in a lower effective interest rate for the borrower. The issuer remains responsible for repaying the principal on the bond.” [xvii]

The State of Alaska has a lot of incentives as well. Some notable incentives are state net metering, Sustainable natural alternative power program (SNAP), and The Alaska Energy Authority (AEA) issues grants out of the Renewable Energy Fund (REF).

State net metering rules provide an incentive for individuals and businesses to invest in their own small renewable energy systems by allowing them to sell excess power they produce back into the grid. Alaska’s net metering regulations, passed in 2010, apply to renewable energy systems of 25 kW or less, and require large utilities to purchase power from customers, up to 1.5% of the utility's average load. In addition, some utilities have their own incentive programs that allow individuals to sell power back to the utilities. Fairbanks' Golden Valley Electric Association (GVEA) has developed a Sustainable Natural Alternative Power (SNAP) program. SNAP allows customers who wish to support renewable energy development to do so by contributing to a fund that is held in escrow by the utility company. Individuals in the GVEA service area who want to produce up to 25 kW of renewable electricity for the grid are paid from the escrow fund in proportion to the amount of power they produce, plus the utilities avoided fuel cost. [viii]

"Golden Valley Electric Association's (GVEA) SNAP program encourages members to install renewable energy generators and connect them to the utility's electrical distribution system by offering an incentive payment based on the system's production on a dollar per kilowatt-hour ($/kWh) basis. The amount paid to participating renewable energy producers depends on the total amount contributed by GVEA supporters. Qualified alternative energy resources" includes electricity produced from generation facilities that are fueled by: (a) wind; or (b) solar energy and other renewable energy resources. GVEA limits these resources to 25 kilowatts of capacity or less per system. There are two different SNAP programs available:

- SNAP: Producers of renewable power do not use any of the power they produce. The power produced is measured separately from the existing home or business energy use by a separate meter. GVEA also developed specific standards for the interconnection of SNAP generators to its distribution system.

- SNAP Plus: Producers of renewable power can also net meter through this program. SNAP Plus participants receive an annual payment and a monthly credit for net excess generation." [xvii]

"In May 2008, Alaska enacted legislation authorizing the creation of a renewable energy grant fund. The legislation recommended that the Alaska Energy Authority (AEA) administer the program. The grant program is intended to provide assistance to utilities, independent power producers, local governments, and tribal governments for feasibility studies, reconnaissance studies, energy resource monitoring, and work related to the design and construction of eligible facilities. In order to be eligible for a grant, a project must be located within Alaska and be a new project not in operation on August 20, 2008, or an addition to an existing project made after the same date. Projects should be constructed and operated for the public benefit. The list of eligible technologies includes solar, wind, geothermal, hydrothermal, certain types of biomass, biogas, wave, tidal, waste heat utilization, river in-stream power, and hydropower. Also eligible are: fuel cells that use hydrogen generated from an eligible renewable resource or natural gas; certain natural gas projects located in small communities; and, electricity or natural gas transmission and distribution infrastructure projects that link an eligible project to related infrastructure. The AEA will not actually approve projects; it will issue recommendations to the state legislature, which will make funding decisions. The AEA evaluates projects on the public benefit of the project using an economic model for consistent parameters and assumptions between projects. There is usually one round of funding per fiscal year, and the first solicitation took place in September 2008. The most recent solicitation, Round VIII, closed on September 22, 2014. Solicitations accepted during one fiscal year are funded in the following fiscal year. The original enabling legislation stated an intention to provide $50 million in funding annually to the program for five years. HB 250 (2012) extended that intention to provide $50 million in funding annually for each of the 10 fiscal years until the program expires on June 30, 2023, but this amount is subject to legislative appropriation. Through FY 2014, the legislature has authorized $250.3 million in grants. The allocation plan recommends that 20% of the funding go to reconnaissance, feasibility and resource studies, and the remaining 80% be awarded to final design, permitting and construction projects. In 2013, AEA also established a target allocation for heat projects to compose 30 percent of the total funding recommendation. AEA has put forth the following funding limits per grant:

- Reconnaissance, and Feasibility and Design studies: 20% of anticipated construction costs, not to exceed $2 million
- Final Design, Permitting, Construction and Commissioning: $4 million per project in "Low Energy Cost Areas" and $8 million in High Energy Cost Areas " [viii]

Table 2 shows the total cost and benefit of current operating projects funded by AEA.

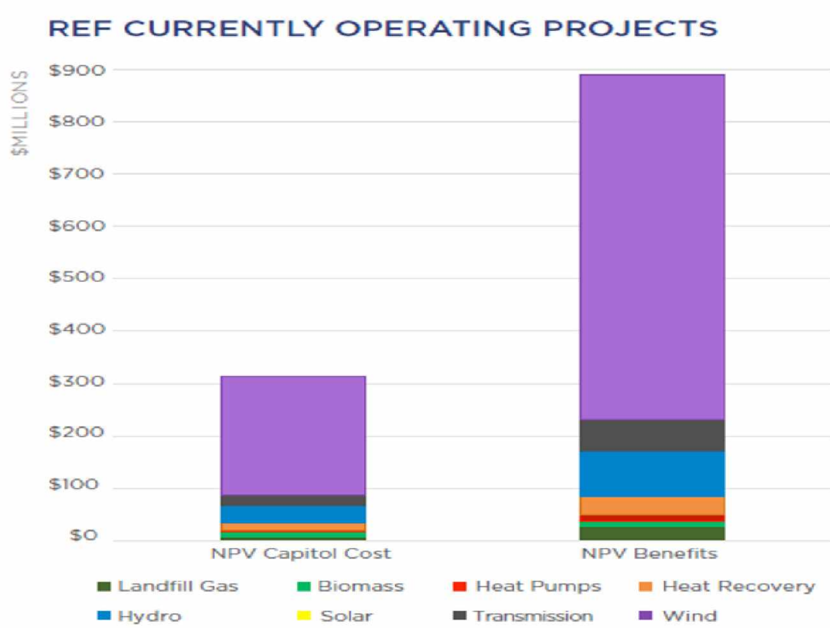


Table 2, REF Currently Operating Projects (Source: AEA) [xix]

Load Following

A significant percentage of the available electric power throughout the day is called base load power. Much of the base load power is produced by large coal (and nuclear) powered generators. Base load power is the minimum amount of power that a utility company makes available to its customers. This minimum is calculated to insure that enough spare capacity is available at all times. When demand is lower than the spare capacity, the unused electricity is simply unused. Coal produced energy is still generated and the electricity is available whether it is used or not. Without this “wasted” spare electricity, customers would be without reliable electricity. [xiv]

Load and generation must be continuously balanced on a nearly instantaneous basis in an electric power system. This is one of the characteristics that makes supplying electricity different from providing any other public good such as natural gas, water, telephone service, or air traffic control. It is a physical requirement that does not depend on the market structure. How load and generation are balanced does depend, in part, on the structure of the electricity markets. One benefit of interconnecting multiple control areas is that balancing load and generation within a single control area does not have to be perfect. The North American Electric Reliability Council (NERC) has established rules governing how well each control area must balance load and generation. Control Performance Standards 1 and 2 (CPS1&2) establish statistical limits on how well each control area must balance minute-to-minute fluctuations. Inadvertent interchange accounts track longer term differences. In all cases the total system remains in balance (otherwise blackouts occur). When one control area fails to balance its load with its generation, generation in another control area provides the balance. [xiii]

Wind turbines that are connected to the electrical grid cannot reliably produce a steady wave. Most wind turbines have a maximum and minimum wind speed they can operate in. A turbine that is outside of its operating wind speeds is not producing power. The wind speeds change constantly and forces other power producing systems to pick up the lagging production. Robert Bryce stated "Because wind blows intermittently, electric utilities must either keep their conventional power plants running all the time to make sure the lights don't go dark, or continually ramp up and down the output from conventional coal- or gas-fired generators (called 'cycling'). But coal-fired and gas-fired generators are designed to run continuously, and if they don't, fuel consumption and emissions generally increase. A car analogy helps explain: An automobile that operates at a constant speed—say, 55 miles per hour—will have better fuel efficiency, and emit less pollution per mile traveled, than one that is stuck in stop-and-go traffic." [vii] Current technology is not available to quickly turn coal plants on and off when the wind turbines are operating inside or outside of their operating range. So even though there is a perception of less emissions with wind energy, the coal plants still have to burn coal at the same rate.

New technology has been developed that does ramping of power based on wind speed. The National Center for Atmospheric Research (NCAR) has developed a wind prediction system for Xcel Energy; the power company with the largest wind capacity in the United States. Advanced modeling, data assimilation, now casting, and statistical post-processing technologies comprise this system. This power prediction system uses strategically placed monitoring devices to forecast wind then correlates that data with forecasted power usage and forecasted power ramps in a system. "NCAR has configured a wind energy prediction system for Xcel Energy that integrates high resolution and ensemble modeling with artificial intelligence methods to produce a state-of-the-science wind power forecasts. In addition, the forecasting system includes specific technologies for short-term detection of wind power ramps, specifically a variational Doppler radar assimilation now casting system and a heuristic expert system. Here we have described the system and reported on its behavior for a specific case. For this case, the ramp subsystem performed quite admirably, as did the core wind energy forecast system. Preliminary results indicate that the ramp detection system shows broad success. Further case studies and a full statistical analysis of these systems are in progress. Wind power forecasting can significantly improve grid integration by improving reliability in a manner that can minimize costs." [xv] Renewable energy research is always ongoing to improve the efficiency and effectiveness of load following.

Turbine Designs

Wind turbines typically come in two varieties with varying designs, including vertical and horizontal axis. This project will focus specifically on three-blade horizontal axis wind turbines and their scales with regard to production capacity. Industry standards vary with regard to scale, so for this project we will define small scale (aka micro scale) [xx] as 0 to 25 kilowatt (kW), medium scale as 26 to 100 kW, and large scale as greater than 100 kW. We also state this per turbine, not as combined output. Given these values, we hope to show how the economic benefit for a single individual can be calculated regardless of turbine scale or output capacity.

Turbine Generator

Wind turbine generators can be designed to function as Alternating Current (AC) or Direct Current (DC) production devices. DC type devices use a fixed magnetic field with a rotating armature, commutator and brush. The commutator is a mechanical rectifier that converts single phase AC electricity to DC electricity. DC electricity is the easiest to produce and store via batteries, heat, or as heated water, however, most household and production systems in the United States (US), operate from three phase AC production that can later be split into the single phase electricity you might find in a household wall plug. DC is somewhat problematic to send over long distances because of transmission line heating. Further, if components such as a brush or commutator fail in a DC system the electricity converts to AC which can be dangerous or damaging to equipment. Transmitting in AC allows greater transmission distances at higher voltages and lower currents. Turbines of any size will typically generate three phase power in the US. This configuration is needed because most transmission infrastructure is designed for three phase.

Choosing a generator design should factor in a plan for power usage such as light, heat, or a combination. Would the user want to save and store the power, run the entire house, just heat water? These will all have factors on the turbine generator design and the production scale an individual would need to achieve. Further, as part of the design scenario, common practice for location, height of tower, safety, and minimization of infrastructure for transmission are factors that need to be considered for efficient power production.

Current turbines of any size that are tied directly to a grid infrastructure or sold on the open market must be certified by the Underwriters Laboratories (UL) [xxi] or in Canada the Canadian Underwriters Laboratories (CUL). This rating certifies the construction of the mechanical and electrical systems as well as safety standards in the National Electrical Code (NEC) for a turbine as well as the inverters and batteries that can be used to grid tie a system. However, certification, at this point, does not extend to custom built systems that are tied to a UL rated battery bank that is in turn connected to a grid with a

UL rated inverter. As long custom built systems can have their power converted by a UL rated system and are following Occupational Safety and Health Administration (OSHA) and NEC guidelines for installation and operation, individuals can create custom systems.

Small Scale Generator

Small scale generators (Figure 7), as per this paper, are those which produce up to 25 kW of power. We will examine these types with triple blades on a horizontal axis. These turbines are typically designed as furling tail systems that use the wind itself to turn them out of the wind as a way to avoid over speeding. Small scale systems typically have a rotor with blades attached to a set of permanent magnets or wire coils that produce an electromagnetic flux field to induce three phase voltage in another set of coils that create usable output voltage. The secondary coils are typically stationary and are part of the structure called the stator. The wire that makes up the coils in the stator must be sized to handle the amount of production that will be produced. Wire of too small a gauge can cause overheating and damage in the stator. Further, orientation and direction of the windings in these coils is important for proper power production in the coils. The stator is connected to a slip ring assembly which transmits the energy to a load, battery bank, heating (water or space) or to the grid to be used as a form of electrical energy. The slip ring assembly can also be used as a commutator to become a mechanical rectifier which can convert the three phase AC electricity to DC electricity depending on the storage option. However, transmitting in AC form is more efficient for transmissions of longer distances due to wire size and heat loss factors. If DC is needed from the production, say to store in batteries, transmission in AC form to the battery bank and then using a solid state rectifier to convert to DC for storage is more efficient with less loss in heat energy and smaller transmission wires.

Figure 7, 10kW small wind turbine (source: www.chinawindenergy.en.alibaba.com)

Medium Scale

Medium scale systems (Figure 8), from 26 kW to 100 kW, can be either permanent magnets or electromagnetic. However, most modern technology can eliminate the use of permanent magnets as they are bulky, brittle and dangerous to handle. Many manufacturers have moved away from permanent magnets in favor of large electromagnetic coils as you might see in an alternator, motor, or generator using the wind as a source of inductive flux energy. Large bulky magnets, because of their structure can vibrate free of their rotor housing, crack and break with temperature extremes, and produce a hazard when replacing. Too, these medium scale systems have moved away from furling tails to control over speed condition in favor of sensors in the nose of the turbine and actuating motors to move the turbine out of the wind, or vary blade pitch to slow down the turbine if wind is excessive.

Figure 8, Horizontal wind turbine EOL 100kW (Source: www.blade-wind-tech.nl)

The medium scale systems also start moving away from storing energy as cost for batteries is extreme, and so installations favor either grid tie or direct usage for the energy produced. Grid tie allows the electricity produced to be fed directly into the grid infrastructure of the local utility and used to power homes, businesses, and industrial facilities. The down side to this production is that current technology has not allowed utilities to use produced power to reduce their output directly; in fact, most utilities still have to be able to produce full power with fossil fuels in case there is no wind. Utility turbine ramping technology, called wind/diesel, is still in development stages and has yet to be implemented in active utility smart grids. This is not to say the energy produced with wind is not used however, over production on windy days sees loss because of a lack of energy ramping technology that can respond to changes in wind speed and utility turbine production speeds.

Large Scale

Large scale systems (Figure 9), 101 kW to 2 Megawatt (MW), are electromagnetic in design. Like medium scale, they have a rotor with pitching blades or sensors to control over speed conditions, a stator, and a gearbox to ramp up production with minimal wind speed and blade rotation, and significant power control systems to regulate voltage sent to the grid infrastructure. Large scale systems require much heavier transmission lines as their output is typically in the high kW or MW range. These large systems are too large to store in battery banks or other storage mediums due to cost, and are typically fed directly to grid infrastructure for use as electrical energy by local homes, businesses and industry.

Figure 9, Blue Creek Wind Farm, Ohio, United States of America (Source: www.power-technology.com/projects/blue-creek-wind-farm-ohio/blue-creek-wind-farm-ohio6.html)

More and more, the US and other countries are now installing large scale wind (Figure 3) to offset fossil fuels for electrical production. This use of natural energy to fulfill our electrical needs also eliminates the global warming chemicals found in fossil fuel use. The largest wind turbine in production today is the 7MW turbine (Figure 10). Large scale systems are used more and more both inland and offshore. Some arrays account for hundreds of these systems, each of which can power hundreds of homes on a daily basis. Offshore production is extremely important as there is little to no interruption of the wind by structures, mountains, or other objects, however, cost is substantial for the infrastructure, construction, and maintenance of these systems.

Despite costs, many individuals, organizations, and countries consider the cost savings to the environment to more than compensate for the cost of their installation and as oil costs become unpredictable as fields decline in the coming decades, their usage will maintain the electrical needs of the countries that deploy such systems.

Figure 10, Samsung's 7MW prototype (Source: www.windpowermonthly.com)

Other Designs

While it is not the intent of this paper to use information from systems other than those described in this projects outline, it is important to note other wind technologies being used and developed. The three blade horizontal access turbine is by no means the only source of wind energy, although it is the most used, and in fact there is a great variety of wind turbines that aid in offsetting electrical costs that are not of three-blade horizontal type. Some examples of these include:

- Vertical axis turbines (Figure 12)
- Savonius turbines (Figure 13)

Figure 11, Vertical axis wind turbine (Source: www.dforcesolar.com)

Figure 12, Savonius Turbine (Source: www.nared.org)

UAF Small Turbine Design

As part of an educational and renewable energy grant, this project received enough funding to purchase a solar array, but not enough for both a tower and pre-built turbine. There was enough money to build a 3kW turbine so the construction of the turbine was incorporated into the process technology program.

The purpose of this design is to achieve the best power production possible however, this turbine was hand constructed and will not have the accuracy of a machine produced system. Power production of a wind turbine was first defined by German Physicist Albert Betz as "Betz's Law", which states that no sealed wind turbine can exceed a production output in excess of 59.3%. Most commercial turbines only obtain 75%-80% of that value. [xxiii] To achieve maximum power, Betz developed the following formula:

$$P_{max} = \frac{16}{27} * \frac{1}{2} * \rho * S * v_1^3, where;$$

P_{max} = Maximum power produced in Watts

ρ = Density of fluid

S = Cross sectional wind swept surface area

V_1 = Velocity of wind approaching blades.

The following section will break down the construction process, calculations and measurements used in the design. The goal was to build a system that was strong enough to withstand the harsh weather Alaska experiences including high winds, extreme temperature swings, and varying humidity

Components

Frame

The frame was constructed using existing designs and some modifications based on results from testing of extremes in the Fairbanks region. A graduate structural engineer at UAF verified that the steel used for the frame (Figure 13) and rotors could withstand the environmental factors. Each frame is custom with regard to the production limit of the turbine. In general, ¼ carbon steel was used for the 1 kW systems, 3/8 in carbon steel was used for the 2 kW systems, and ½ in. carbon steel was used for the 3 kW systems. Further, the frame includes a horizontally furling tail mount, a method for reducing blade rotation in heavy winds (Figure 14). The system also uses slip ring technology to keep cables from tangling in the tower (Figure 13). The slip ring is mounted in the top of the frame and connects to wires going down the tower. The slip ring transfers 3 phase AC to a rectifier just before the batter and tracking system. Other modifications to the frame will include and RPM meter and Anemometer for tracking wind directly at the tower instead of NOAA airport 10 m data.

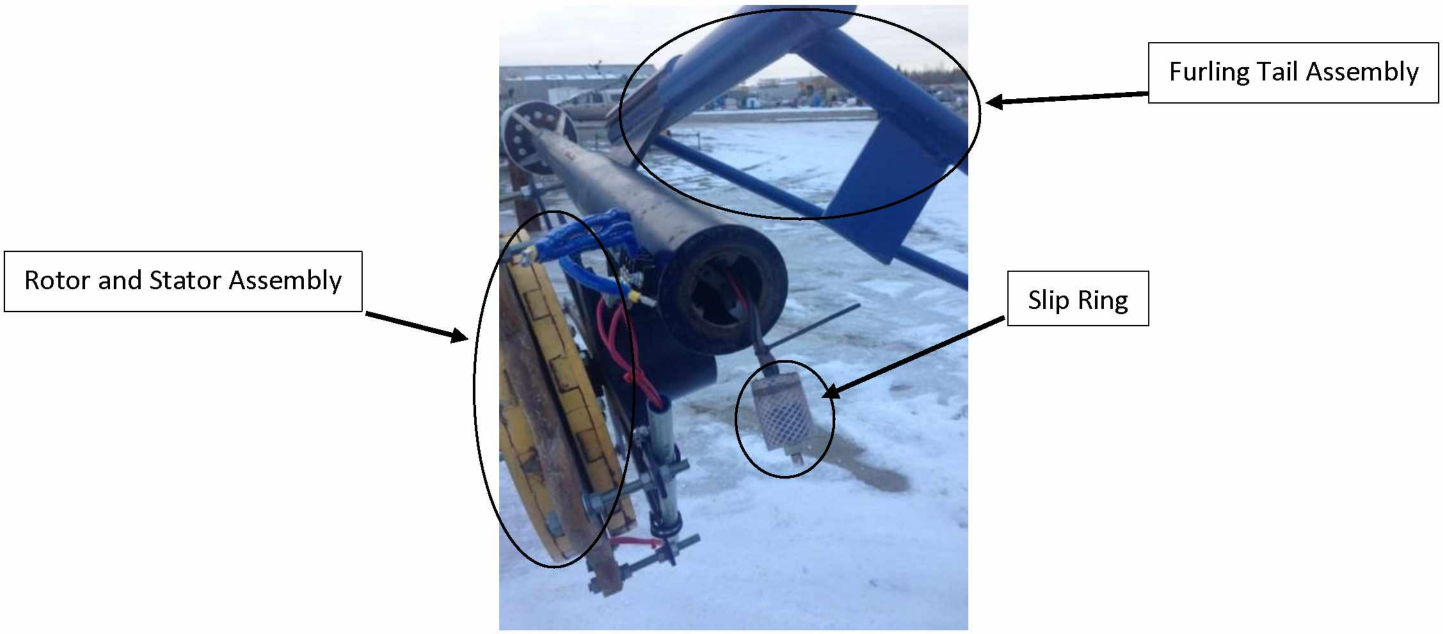


Figure 13 - UAF Built 3 kW Turbine

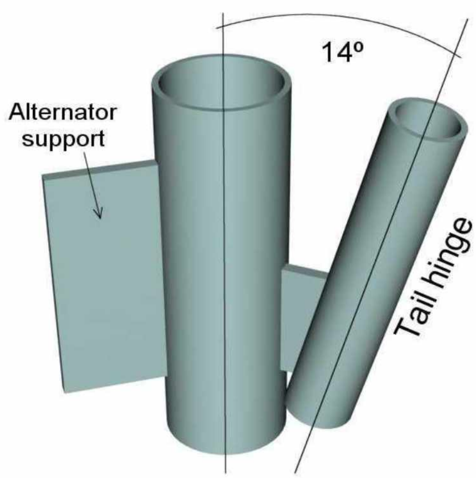


Figure 14 - Furling Tail Mount (source scoraigwind.com)

Tail

The tail furling follows some simple rules of angle of offset (figure 15). According to Hugh Piggott, the wind turbine diameter will determine the tail boom length and tail vane area. The tail boom should typically be the length of a single blade and the area of the tail vane should follow the formula: [xxii]

$A = \frac{D^2}{40}$ Where;

A = Area of the tail vane

D = Diameter of wind swept area of turbine

As an update to this procedure for tail design, we note that the storm passing through Fairbanks in winter 2013 that recorded 82 mph wind gusts at the Fairbanks, Alaska airport where we tested our unit. At that time we found that in extreme winds, the furling tail is not enough to stop the turbine completely and in our case, lifted the tail from its mount causing it to fall and spin into the blades resulting in 2 sheared blades. As a modification to Hugh Piggott's design, we suggest adding a vertical restraint to the tail to keep it from lifting off the tail mount. We will institute a chain restraint that still allows horizontal motion but limits vertical lift beyond the tail mount.

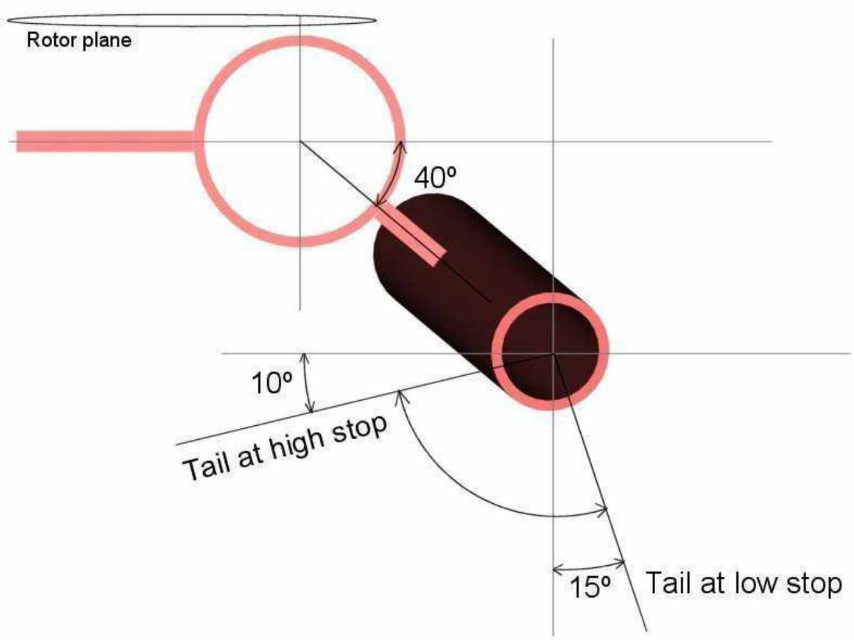


Figure 15 - Furling Tail Angular Offset (source: scoraigwind.com)

Hub and Rotors

The main generator is composed of a hub and bearing that is attached to two opposing rotors (Figure 16). The rotors plates contain magnets that oppose each other and sandwich the stator coils between them. The magnets from each rotor will face each other, but the polarity of opposing magnets is opposite. If a magnet on the bottom plate is North polarity the magnet directly above it on the second rotor plate will be a South polarity so they attract. The steel plates must be of sufficient strength so that their yield will be higher than the magnetic forces pulling on them. As stated earlier, UAF's turbine used a ½ inch carbon steel plate. Each plate contains sixteen 1.32 Tesla magnets (figure 17) with a pull force of 180 lbs. The magnets are evenly distributed on the rotors at 22.5 degrees for our system. The magnet to coil ratio is 4:3 respectively for our three phases. Other phase configurations are possible, however, the standard used for systems in the U.S. are three phase. This configuration can reduce cogging and will maximize low wind start-up of the turbine by offsetting the magnets of opposite polarity from the coils.

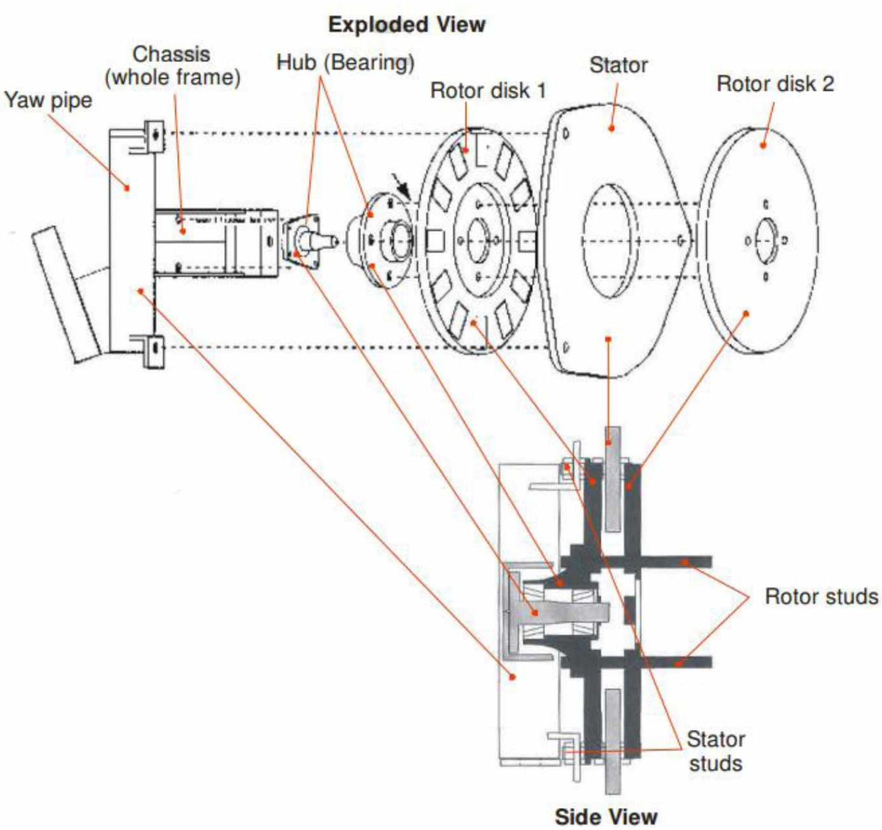


Figure 16 – Main Generator (source: http://www.re-innovation.co.uk/web12/images/stories/redocuments/information/SIBAT/WT_Stator_Guide.pdf)

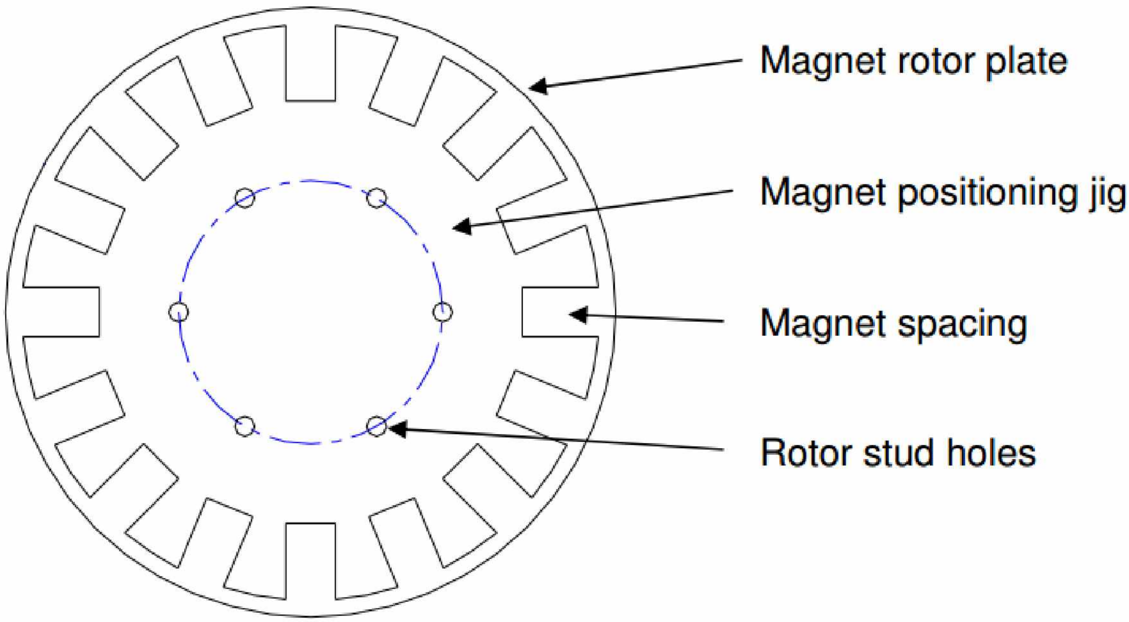


Figure 17 – Plate with Tesla Magnets (source: http://www.re-innovation.co.uk/web12/images/stories/redocuments/information/SIBAT/Wind%20turbine%20rotor%20disk%20manufacturing%20guide.pdf)

Stator and Coils

The stator is a fixed structure that contains the coils. As magnets move past the coils they make use of Faraday's Law of Induction. [xxiv] Faraday's Law states:

$\phi_B = \iint_{\Sigma(t)} B(r,t) \bullet d\mathbf{A}$, where

Φ_B = Magnetic Flux

$d\mathbf{A} = d\mathbf{A}$ is an element of surface area of the moving surface $\Sigma(t)$

B = Magnetic Flux Density

$B \bullet d\mathbf{A} = \mathbf{B} \cdot d\mathbf{A}$ is a vector dot product (the infinitesimal amount of magnetic flux through the infinitesimal area element $d\mathbf{A}$).

For the stator coils we used #16 AWG with 100 turns for a 48 Volt system. The voltage induced on the coils is a factor of Lenz's Law which states:

The polarity (direction) of the induced voltage is given by Lenz's law, which states that it will be such as to oppose the change in current and is represented by the equation: [xxiii]

$v = L\frac{di}{dt}$, where;

V = Voltage induced in volts.

L = Magnetic field around a current carrying conductor with units of Henries.

$\frac{di}{dt}$ = The change of current over the change of time in seconds.

The stator is comprised of 12 coils that are arranged in a 3-phase configuration. Each phase uses four coils connected in series. One end of each colored phase is tied to the other phases as a neutral, the other three ends will attach directly to a load, a rectifier, or an inverter. The 3 phase 12 coil configuration is as follows (Figure 18):

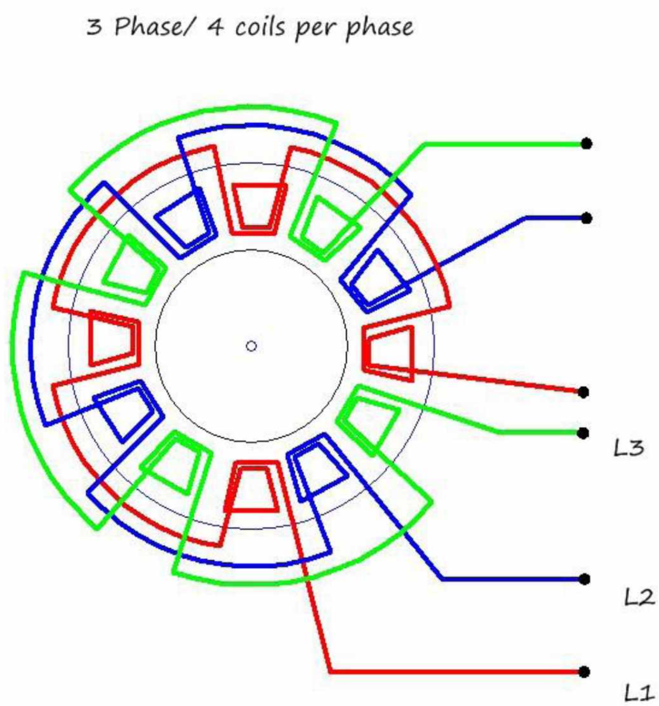


Figure 18 – 3 phase, 12 coil configuration (source: www.fieldlines.com, 12 Coil 3 Phase Stator Configuration)

The stators will transfer current from the turbine to be used as an active load, stored in a battery bank, or transferred to the local utility grid.

During the collection of wind data at UAF, it was discovered that there is another fault in the design. In excessive winds the tower produces extreme vibration which caused the magnets to vibrate from their mountings and were tossed to the ground. A modification is being make in the new rotors plates is to weld a 1 inch lip around the edge of the rotor plate so the magnets will not vibrate free. Part of the problem is the tower was not designed for a custom turbine, but was modified to accommodate the turbine. The original turbine for the tower was not a furling tail, but instead used sensors to detect wind direction. It was discovered that the furling tail caused a vibration through the hollow tower that transferred to the turbine in high winds. Future modifications to the tower will include shock absorbing material to reduce the vibration in addition to the rotor modifications. The existing tower was chosen because of the cheap cost and convenience of having a hydraulic tower; making rising and lowering of the tower for maintenance much simpler. When the turbine was installed on a portable wind turbine system, vibration was not an issue as the inside diameter of the tower was under 4 inches. The new tower has a two foot diameter at the base, but narrows to a custom fitting at the top was constructed to work with this turbine. The large hollow space vibrates significantly during heavy winds as a result of the furling tail action.

Locations and Tower

Wind power in interior Alaska is sketchy at best for large scale systems. [xxv] However, when researching areas to deploy the tower, a desire for a location that was close enough to study and test turbine designs and track wind data. NOAA 10 m wind data showed that surface wind at the airport produces enough wind to power a turbine more frequently than other locations. The FAA approved the installation of the tower (appendix 2) at the Van Horn Fairbanks Pipeline Training Center. The site had a clearing near the center and the tower was tall enough to rise 20 feet over the building. Despite having good success in prior years with the portable tower, 2015 provided to be an extremely calm winter with very little wind. Despite this problem, the center is probably among the best places near the city to receive enough wind to keep the 48 volt load charged to feed the grid. In hindsight, someplace like Murphy Dome or Delta Junction would have been more practical, but more difficult to access the turbine for modifications and repairs.

Despite issues with the wind turbine, the data log has recorded 3 kW production since installation. The turbine was damaged from heavy wind at the end of March so the system was taken down for repairs.

Wind Data Analysis

According to our initial data, the highest economic impact was for small, then medium, then large scale turbines. This was calculated over a one year period with averaged monthly wind and turbine production data from three separate sites in Alaska. The small scale system was located in Fairbanks, approximately two miles from the Fairbanks airport. The medium sized system was located in Delta Junction, Alaska. The large scale system was located in Eva Creek, Alaska.

The small scale system, built by UAF, only received data tracking equipment from November 2014 to March 2014, thus limiting the data points needed for a complete year, nevertheless, the five months of data was used. The medium and large scale systems use one year of data. This shortage of data will cause the model to skew because in conjunction with the lack of data, the region where the turbine was flown received only a minute amount of wind during this period. Further skewing of the medium scale system may be noticeable due to the data received. In this case a graph was provided by the owner of the 100 kW system and points were taken from peaks and troughs on the graph. To minimize this skew, points were calculated between the peak and trough using averages. For instance if a peak value was 12 and a trough value was 2, the average of these two values can be calculated to find the middle point between peak and trough. Further, the new average can be used as a new trough to calculate another point between peak and that average. Additionally, from the average to the trough value we can average yet another point for kilowatt production. Lastly, averaging the wind using the same technique will provide a much more economic model calculation.

Cost data was available in detail for the small scale system, however, the medium and large scale data providers only provided total kW (multiple turbines) and total cost, but did not provide a cost per turbine. Therefore, cost was calculated using a ratio of kilowatts produced to total dollars to determine capital costs and O&M costs. The equation that is used to calculate this ratio is:

$$\frac{\textbf{\textit{Total Cost (Total Funding or Total O\&M)}}}{\textbf{\textit{Total MegaWatts}}} = \frac{\textbf{\textit{Turbine MegaWatts}}}{\boldsymbol{X}}$$

Small Scale

O&M	$200.00
Total Cost	$18,545.20
Grant Money	$18,545.20

Medium Scale

Capital Costs	$128,814.00
O&M	$5,429.00
Grant	$19,000.00

Large Scale

Capital Costs	$7,833,333.33
Legislative Appropriation	$833,333.33
REF	$300,000.00
CREBS (1.05%)	$6,700,000.00
Yearly O&M	$100,000.00
Yearly Road Maintenance Cost	$25,000.00

A table for each turbine was then created with the x-axis depicting average wind speed and the y-axis depicting average kilowatts produced by month. For each table an Excel calculation was made for wind and power. From this an excel calculation was made to identify the standard deviation, correlation coefficient, mean and confidence interval for both wind and power. We used a .05 for alpha to represent 95% confidence interval and the degrees of freedom for each dataset.

Small Scale				
Month	Wind Speed (m/s)	Power (kWh)		
Nov-14	1.09	0.17	0.97	Correlation Coef
Dec-14	1.16	0.00	0.08	Std Dev Power
Jan-15	0.66	0.00	0.24	Std Dev Wind
Feb-15	0.80	0.00	0.43	Mean Power
Mar-15	2.55	1.97	1.25	Mean Wind
5		2.14	4	DoF
			0.05	α
			0.103	95% CI Power
			0.29	95% CI Wind

Table 3 – Small Scale Primary Data

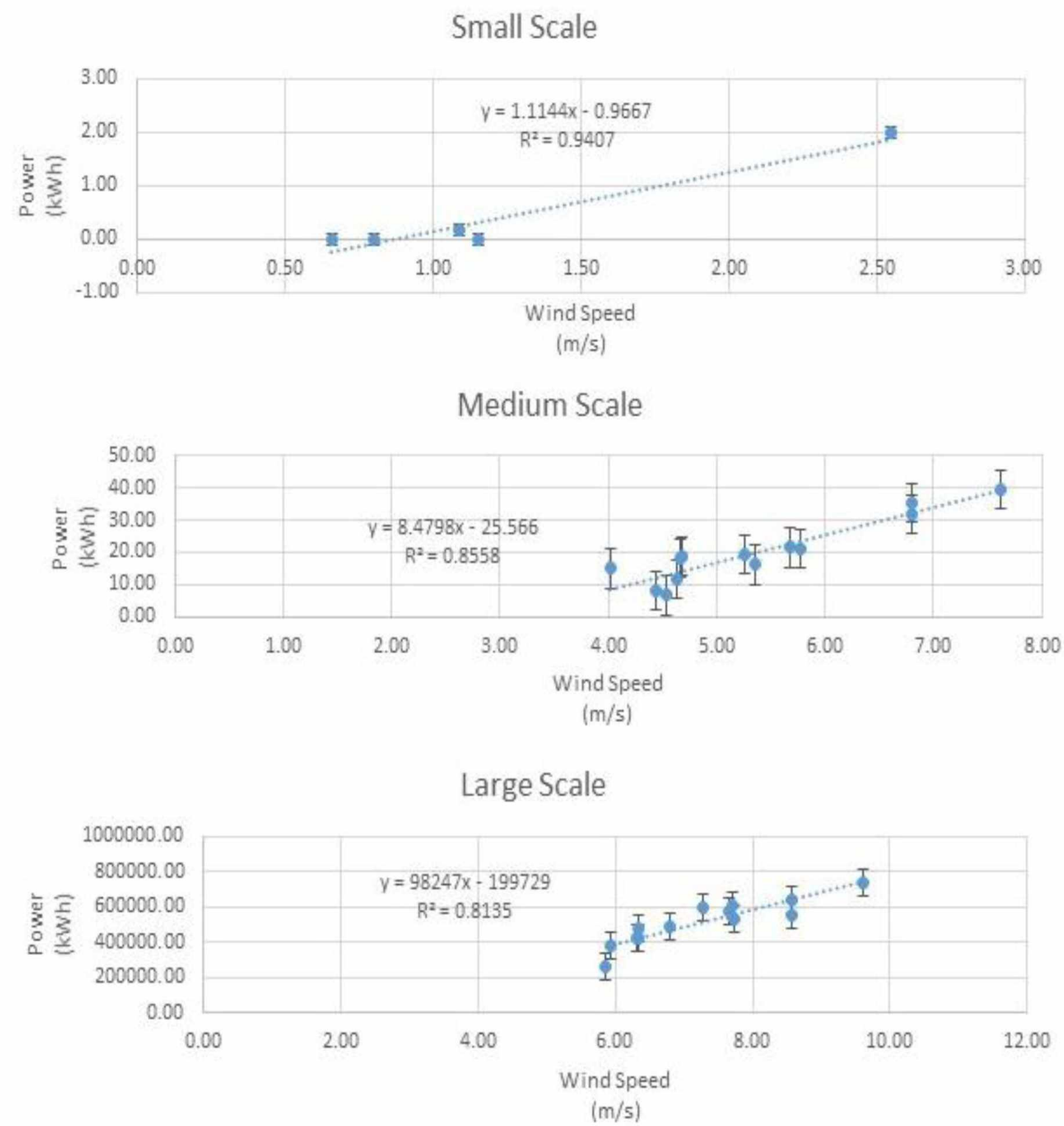
Medium Scale				
Month	Wind Speed (m/s)	Power (kWh)		
Mar-14	5.25	19.50	0.93	Correlation Coef
Apr-14	4.69	18.83	10.00	Std Dev Power
May-14	5.68	21.44	1.09	Std Dev Wind
Jun-14	4.54	6.57	20.26	Mean Power
Jul-14	4.63	11.55	5.40	Mean Wind
Aug-14	4.44	8.12	12	DoF
Sep-14	5.35	16.17	0.05	α
Oct-14	4.01	14.93	6.044	95% CI Power
Nov-14	7.61	39.60	0.66	95% CI Wind
Dec-14	6.80	35.43		
Jan-15	6.80	31.74		
Feb-15	5.77	21.19		
Mar-15	4.67	18.25		
13		263.32		

Table 4 – Medium Scale Primary Data

Large Scale				
Month	Wind Speed (m/s)	Power (kWh)		
Mar-14	7.67	578830.92	0.90	Correlation Coef
Apr-14	6.32	418979.92	125659.29	Std Dev Power
May-14	6.80	491968.92	1.15	Std Dev Wind
Jun-14	6.34	420306.75	516190.47	Mean Power
Jul-14	5.94	385641.50	7.29	Mean Wind
Aug-14	7.27	595086.75		
Sep-14	7.73	528860.08	12.00	DoF
Oct-14	5.87	260169.50	0.05	α
Nov-14	9.60	737444.33	75935.15	95% CI Power
Dec-14	8.57	557119.33	0.70	95% CI Wind
Jan-15	6.35	480804.33		
Feb-15	8.57	645451.58		
Mar-15	7.72	609812.25		
13		6710476.17		

Table 5 – Large Scale Primary Data

Following the table production, a scatter diagram was produced to evaluate the shape and confidence interval of the data graphically; in all three cases the data was visibly linear. Because of the linear form of the data, an R^2 and best fit graph was produced for each system using a linear configuration (Graph 1). Further, the confidence interval was express for each point as a bar to indicate how much value may vary and still be a valid data point on the graph instead of an outlier.



Graph 1 – Primary Wind Data with Confidence intervals

As the data fit a linear scale, a scaling factor and confidence interval for the large turbine (Graph 1) was performed using long term wind data from Healy River (Table 6) to scale against Eva Creek data. This scaling factor would provide a method of adapting both UAF (Table 8) and Delta (Table 7) data to match Eva Creek. Further, the scaling would allow projection of economic costs for all three turbines on a consistent scale.

Healy		Eva Creek Scaled					
Month	Measured	Measured	E:H Ratio	High	High Ratio	Low	Low Ratio
Mar-14	5.23	7.67	1.47	8.37	1.60	6.97	1.33
Apr-14	5.99	6.32	1.06	7.02	1.17	5.62	0.94
May-14	5.81	6.80	1.17	7.50	1.29	6.10	1.05
Jun-14	5.35	6.34	1.18	7.03	1.31	5.64	1.05
Jul-14	4.46	5.94	1.33	6.64	1.49	5.24	1.18
Aug-14	6.43	7.27	1.13	7.96	1.24	6.57	1.02
Sep-14	5.66	7.73	1.37	8.42	1.49	7.03	1.24
Oct-14	2.78	5.87	2.11	6.56	2.36	5.17	1.86
Nov-14	7.09	9.60	1.35	10.30	1.45	8.90	1.26
Dec-14	5.94	8.57	1.44	9.27	1.56	7.87	1.33
Jan-15	4.67	6.35	1.36	7.05	1.51	5.65	1.21
Feb-15	5.53	8.57	1.55	9.27	1.68	7.87	1.42
Mar-15	7.4	7.72	1.04	8.42	1.14	7.02	0.95
		Scale Factor	**1.35**		**1.48**		**1.22**

Table 6 – Scaled Wind Data for Eva Creek

	Delta Scaled					
Month	Measured	Scaled	High	High Scaled	Low	Low Scaled
Mar-14	5.25	7.09	4.59	6.81	4.59	5.59
Apr-14	4.69	6.33	4.03	5.98	4.69	5.71
May-14	5.68	7.67	5.02	7.44	5.68	6.91
Jun-14	4.54	6.13	3.88	5.75	4.54	5.53
Jul-14	4.63	6.25	3.97	5.89	4.63	5.64
Aug-14	4.44	6.00	3.78	5.61	4.44	5.41
Sep-14	5.35	7.23	4.69	6.96	5.35	6.52
Oct-14	4.01	5.42	3.36	4.98	4.01	4.89
Nov-14	7.61	10.28	6.95	10.32	7.61	9.27
Dec-14	6.80	9.19	6.14	9.11	6.80	8.29
Jan-15	6.80	9.19	6.14	9.11	6.80	8.29
Feb-15	5.77	7.80	5.11	7.59	5.77	7.03
Mar-15	4.67	6.30	4.01	5.94	4.67	5.69
	Scale Factor	**7.30**		**7.04**		**6.52**

Table 7– Scaled Wind Data for Delta

	UAF					
Month	Measured	Scaled	High	High Scaled	Low	Low Scaled
Mar-14						
Apr-14						
May-14						
Jun-14						
Jul-14						
Aug-14						
Sep-14						
Oct-14						
Nov-14	1.09	1.47	1.38	2.05	0.80	0.97
Dec-14	1.16	1.56	1.45	2.15	0.86	1.05
Jan-15	0.66	0.89	0.95	1.41	0.37	0.45
Feb-15	0.80	1.08	1.09	1.62	0.51	0.62
Mar-15	2.55	3.44	2.84	4.22	2.26	2.75
	Scale Factor	**1.69**		**2.29**		**1.17**

Table 8 – Scaled Wind Data for UAF

FINANCIALS

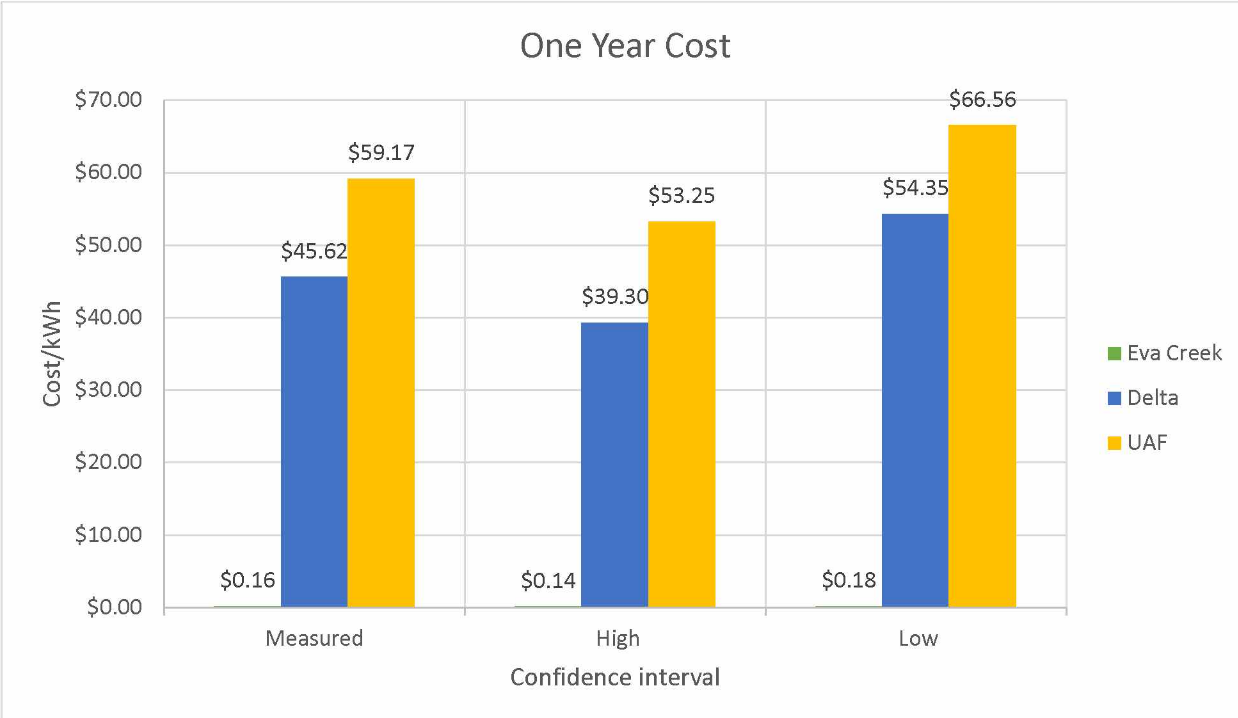
The following equation was used to calculate the cost projection:

$$\boldsymbol{Projected\ Cost} = \frac{(\boldsymbol{O\&M} * \#\,\boldsymbol{Years}) + \boldsymbol{Amortized\ Capital\ Costs}}{(\boldsymbol{Sum\ of\ Projected\ Monthly\ Avg\ Power\ Production}) * \#\,\boldsymbol{Years}}$$

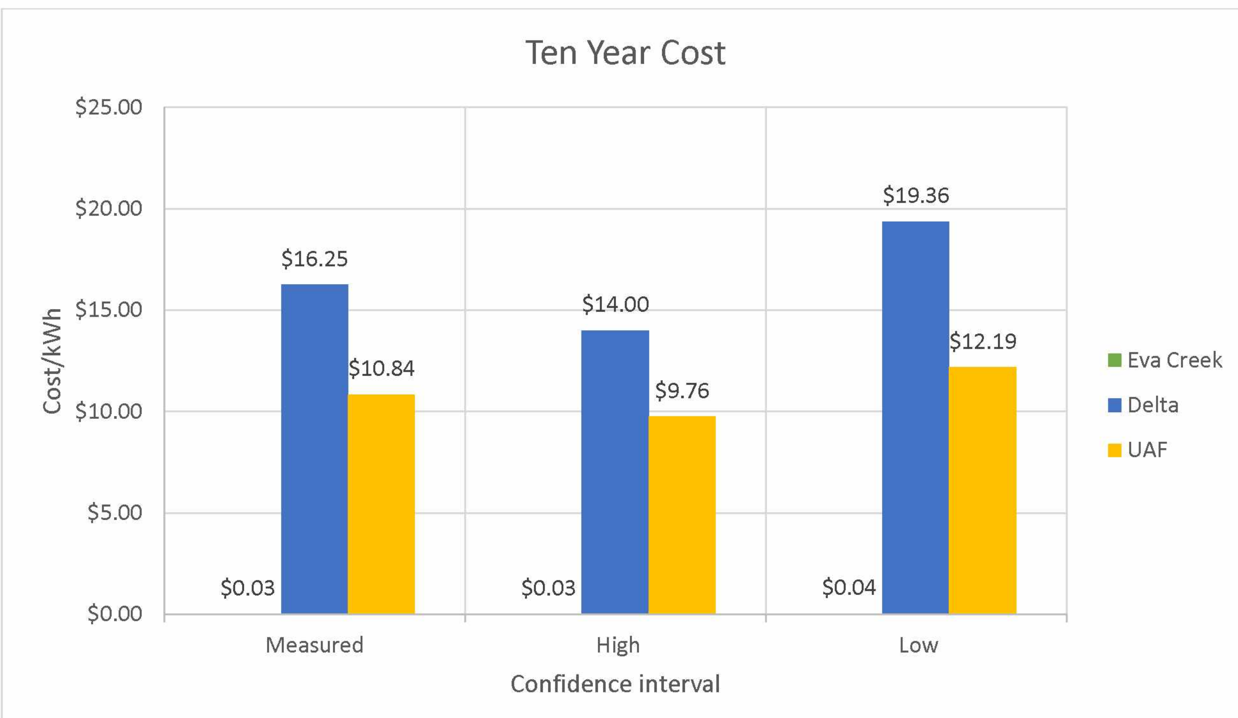
The Projected Cost allows us to compare the cost of planning, installing, and maintaining a wind turbine of any size in an area of wind that is equivalent to the Eva Creek wind farm (Figure 19). The data shows scaled costs including a high and low value representative of the boundaries of the confidence interval for each turbine over one year and projected over ten years. The "PMT" function in excel was used to spread the capital costs out over the projected life of the turbines. For interest rate the current rate for a CREBs loan is 1.05%. This is the rate for the Eva Creek CREB loan so that rate was used across the board to give consistency to the analysis. Ten years is the projected life of each turbine so "10" was used for the number of payments. As shown the one year cost (Graph 2) the cost of production is increased as turbine size decreases. However, the ten year projection (Graph 3) shows that the small scale turbine has a lower price per kWh than the Medium scale. The reason for this is probably because the medium scale grant is a lower percentage of the total cost of the turbine than the other two turbines used in the study.

	EVA CREEK		
Yearly Projected Power (kWh)	**6093912.42**	**6927317.74**	**5260507.09**
$/kWh 1 year	$0.16	$0.14	$0.18
$/kWh 1 year w/o grant money	$0.15	$0.13	$0.18
$/kWh 10 year	$0.03	$0.03	$0.04
$/kWh 10 year w/o grant money	$0.03	$0.03	$0.04
	DELTA		
Yearly Projected Power (kWh)	**417.96**	**485.10**	**350.82**
$/kWh 1 year	$45.62	$39.30	$54.35
$/kWh 1 year w/o grant money	$41.07	$35.39	$48.93
$/kWh 10 year	$16.25	$14.00	$19.36
$/kWh 10 year w/o grant money	$15.80	$13.61	$18.82
	UAF		
Yearly Projected Power (kWh)	**36.56**	**40.62**	**32.50**
$/kWh 1 year	$59.17	$53.25	$66.56
$/kWh 1 year w/o grant money	$5.47	$4.92	$6.15
$/kWh 10 year	$10.84	$9.76	$12.19
$/kWh 10 year w/o grant money	$5.47	$4.92	$6.15

Figure 19 – Scaled Cost per kWh comparison (**NOTE:** These Costs are at the point of production. It does not include transmission to the customer)



Graph 2 – One Year Cost per kWh comparison



Graph 3 –Ten Year Cost per kWh comparison

Initially, the results were surprising as the expected projection values were exactly the opposite of what was expected. The assumption made at the beginning of the project was that the smaller turbine cost would accrue the smallest future cost and be the least expensive to operate, then the medium and lastly the large scale. In reality, the exact opposite appeared to be true where the least cost per kilowatt hour was the largest turbine, then the smallest, then the medium turbine. Several factors could be responsible for the faulty initial assumption including:

- Power produced versus initial cost plus O&M
- Location of the turbines which is a major factor of production
- Size of the turbine
- Wind speed which is a factor of location
- Maintenance down times and costs

<u>Power Produced Versus Initial Cost plus O&M</u>

From the data of the large scale system the cost is significant for initial installation and annual maintenance costs, however, we see significant power produced for that cost which offsets the costs to a much higher degree than the small and medium systems. One year costs follow this expected pattern that we see in the future projection, however, as we project further into the future, the costs continually align more closely with the lower annual O&M costs for the small and medium scale systems. As we see in the 10 year projection the costs for the large systems decrease by only a small amount, however, there is a significant decrease of medium and small. The assumption here would be that over a very long time the small scale should be the least expensive, then medium, and then large due to the consistently smaller O&M for each will be consistent or grow the inflation index at the same rate. Further, the large and medium systems will require 10 year maintenance which replaces large expensive components, while the repair of the small turbine will be minimal by comparison.

<u>Location of the Turbines</u>

The primary factor associated with wind production is the wind itself, and if in fact a turbine is poorly located and receives minimal wind, there is minimal power production. Most locations are studied for one or more years before a significant wind turbine farm project is even considered. In the case this study, the data shows virtually no wind for the small scale in the Fairbanks, Alaska location, while the medium scale system shows significantly more wind, but still has many days without wind. The large system produces the most significant and consistent wind which is consistent with the high altitude location of the turbines.

Size of the Turbine

The size, or kilowatt production capability, of the turbine might lead to the conclusion that the smaller the turbine the easier to build, maintain, and implement. While these factors might be true, their production capability is a fraction of a medium or large scale system. Because of lower O&M costs for a smaller turbine on an annual basis, the cost over a longer term might ultimately be smaller as the results of this study show, however, the amount of time to see that increase would be out of the realm of realistic turbine function.

Wind Speed

Wind speed is a direct function of power production, as the wind blows higher the turbine produces more power. However, ultimately, if a turbine reaches an over-speed condition, the graph becomes more logarithmic as maximum power production ultimately reaches a peak and starts to curve as winds continue to grow. The over-speed condition, in most cases should not be reached as most turbines have a method of reducing their revolutions per minute (RPM) by one of several methods including furling tails, sensors that rotation the nacelle, blades that pitch, or electromagnetic or mechanical braking. Each of these methods has the possibility of failing, thus over-speeding, leading to damage or mechanical failure of the turbine. This situation was experienced with UAF's small scale turbine twice in the last 5 years, the first in March 2014, due to heavy gusting wind that took advantage of the lack of a vertical tail restraint, and the second in March 2015, due to tower vibrations leading to the loss of rotor magnets. These failures lead to a small sample set for UAF to measure, only five months of data. The large and medium scale have more complex methods for controlling wind including failover systems, this leads to better linear wind patterns and more consistent power production.

Maintenance Down Times and Costs

The assumption here is that the smaller the turbine the less the downtime and a cheaper cost for repairing parts. Again, the assumption might be true, but the production capability of a small turbine, is again, only a fraction of that of a large or even a medium sized turbine. Despite the small cost and short downtime, the time the small turbine would have to run to produce the same power as a medium or large is much longer than the maintenance period, therefore, the life of the small turbine would expire long before meeting the power output of the medium and large scale systems.

Conclusion

Despite the initial preconception of the economic impact of small, medium, and large scale systems, the data represents the more accurate projections of cost. Ultimately, small wind, whether located in Fairbanks or scaled for a climate of more wind, will never meet the overall cost savings that was envisioned. Economically speaking, large scale wind appears to be the most efficient way to make a productive influence to a large group of customers.

Regardless of these findings, small scale and medium scale wind are still popular. Population dynamics may prove to be a factor here meaning that for a single household in a rural area, the practicality of funding a large or medium scale turbine would not be financially feasible unless the household was extremely wealthy. The practical conclusion would be to install small scale wind for the household. Likewise, for a small community of a dozen homes or so who could share in the cost of a medium scale might be preferable. Lastly, large towns or cities would require large scale wind to power the large infrastructure.

Small scale is also practical for the storage of energy in the forms such as battery charging or water heating. While this might be cost effective in a small scale situation, charging batteries would not be practical on medium or large scale due to the cost of storage medium required for such large systems. Each of these representations would need to be in an area of sufficient wind production to be economically valuable.

Finally, this study would also provide a valuable tool to provide a cost analysis to determine what scale of wind turbine production would be possible. With minimal modifications, and sufficient data, both short-term and long-term projections could be provided.

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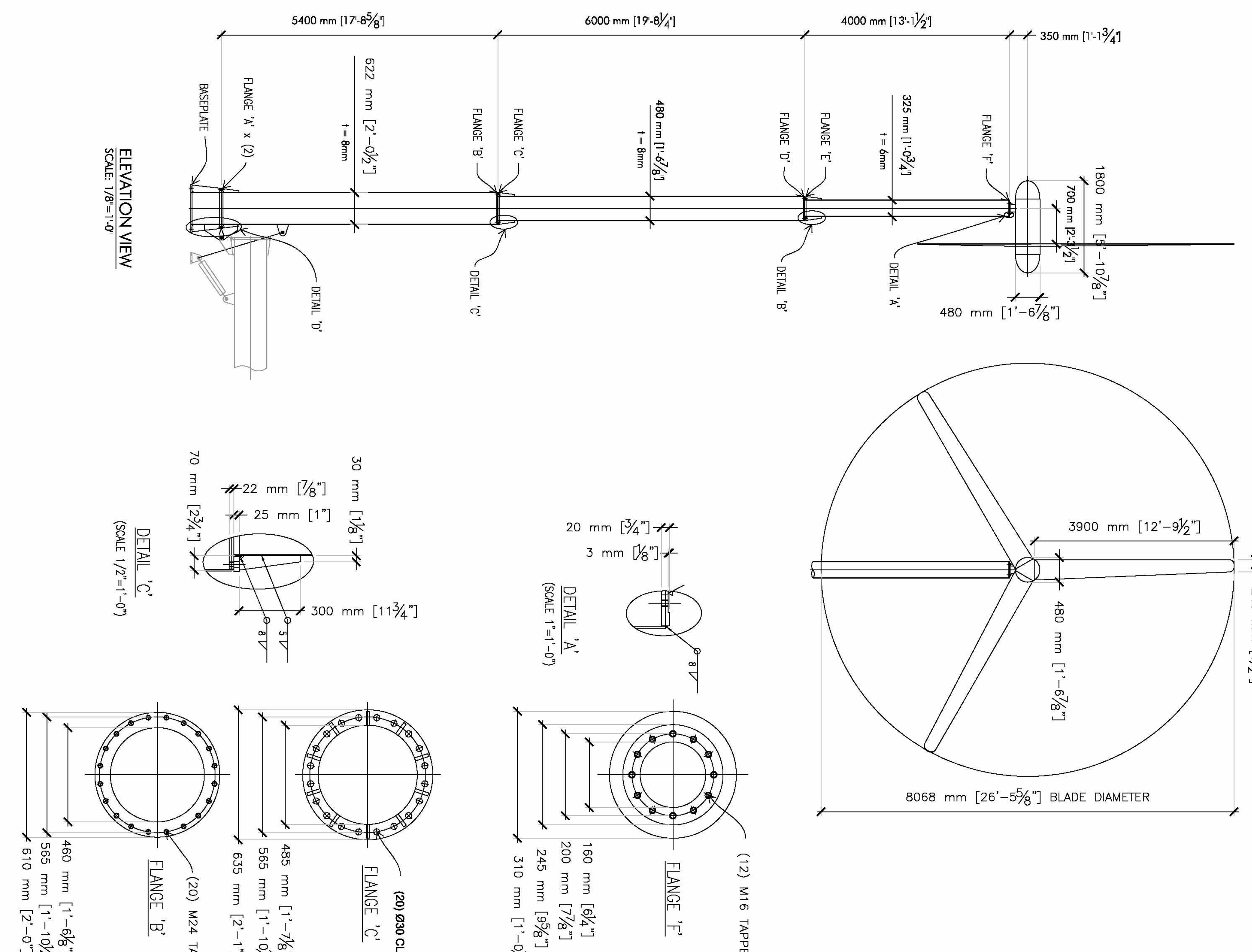
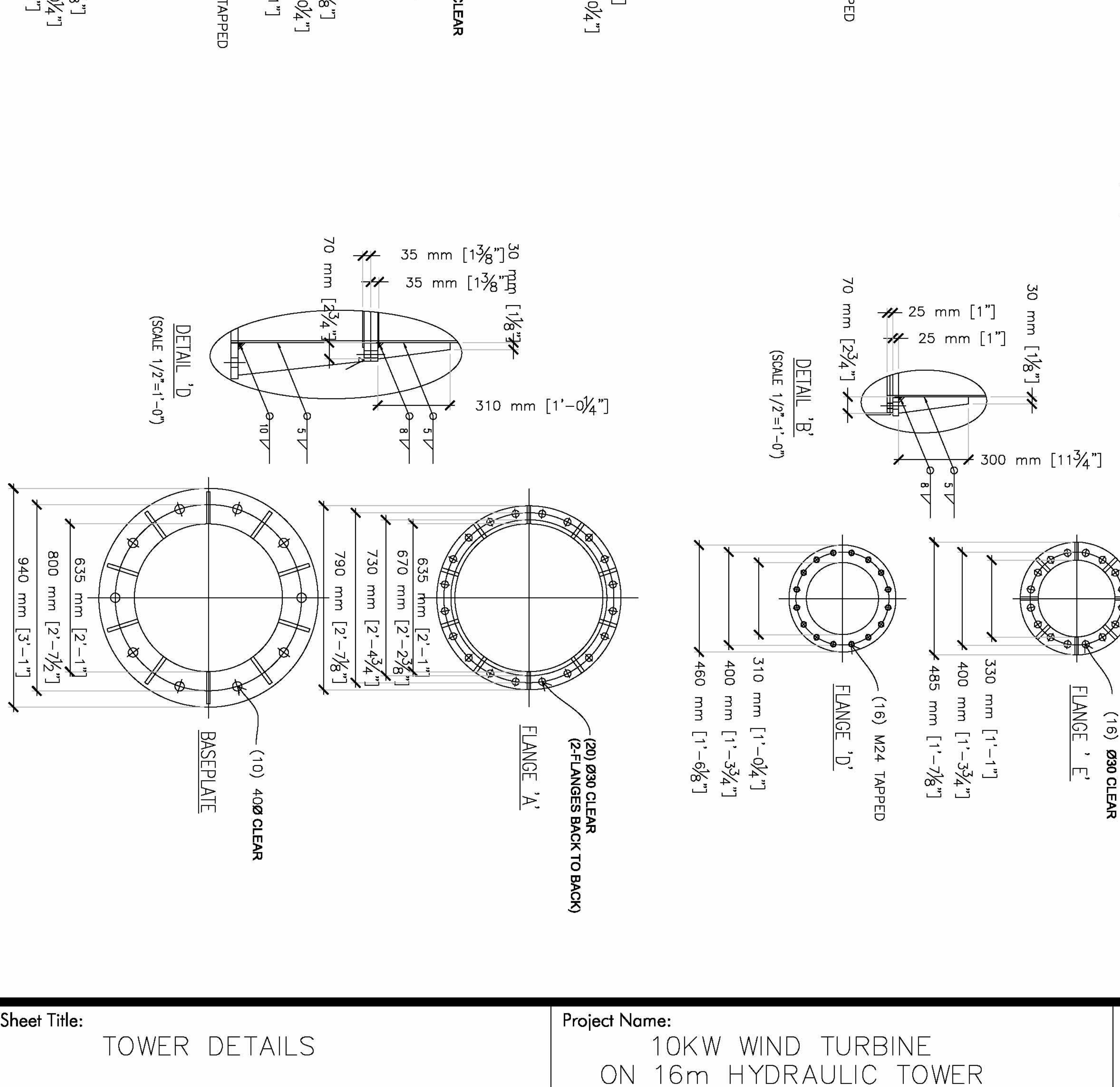


GENERAL NOTES:

1. THE 2006 NATIONAL BUILDING CODE AND THE 2006 ONTARIO BUILDING CODE SHALL BE THE BASIS FOR CONSTRUCTION AND DESIGN OF ALL WORK ON THIS PROJECT

DESIGN DATA:

1. LOCATION - WINDSOR, ONTARIO
2. WIND LOADS - REFERENCE HOURLY WIND PRESSURE, 1/50 YEAR RETURN q50= 0.47 kPa
   FOUNDATION DESIGN q50 = 0.47 kPa
   TOWER DESIGN q100 = 0.52 kPa
3. WEIGHTS
   TOWER 2,051 kg (4,512 lbs)
   NACELL 450 kg (990 lbs)
   BLADES 141 kg (310 lbs)
4. STRUCTURAL STEEL
   - PIPE ASTM A53 TYPE E, GR B., OR APPROVED EQUAL
   - PLATE CSA G40.21 GR 300W (44W) OR APPROVED EQUAL
5. WELDING
   - SHALL BE IN ACCORDANCE WITH CSA S16-01, W47 & W59.
   - ELECTRODES E49XX (E70XX)



Sheet Title: TOWER DETAILS	Project Name: 10KW WIND TURBINE ON 16m HYDRAULIC TOWER	Glos Associates Inc. ARCHITECTURAL + ENGINEERING CONSULTANTS	
Design By: Drawn By: J. GIBSON Checked By: D. LUCIER	Client:	Project No: 08081 Date: 08/05/29 Issued for:	Sheet No: S101

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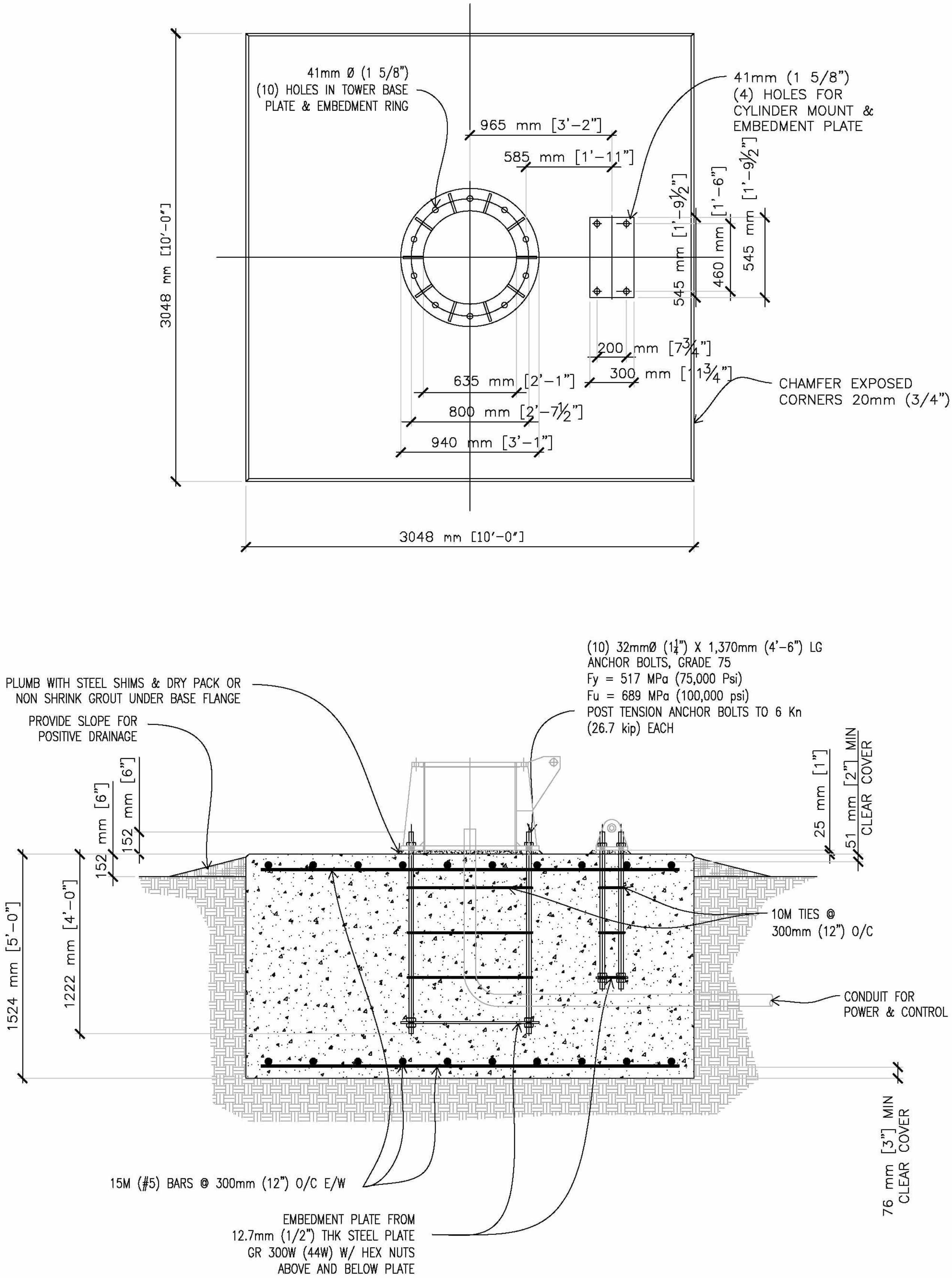


FOUNDATION PLAN

SCALE: 1:1,000

GENERAL FOUNDATION NOTES:

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO COMMENCING WORK. REPORT ALL DISCREPANCIES IN THE DIMENSIONS OR SITE CONDITIONS TO THE OWNER & ENGINEER BEFORE PROCEEDING WITH THE WORK.

2. ALL CONSTRUCTION SHALL CONFORM TO THE FOLLOWING;

CONCRETE:	CSA A23.3-04
AGGREGATE:	C-33
STRUCTURAL STEEL:	G40.21, GRADE 300W
CEMENT:	CSA A23.1
REINFORCING STEEL:	CSA G30.18-M92, Fy=400 MPa

3. FOOTINGS SHALL BE CARRIED DOWN TO NATURAL UNDISTURBED SOIL CAPABLE OF SUSTAINING AN ALLOWABLE PRESSURE OF 96 kPa (2,000 psf). IF ANY SOIL ENCOUNTERED AT THE FOUNDATION LEVEL WILL NOT SUSTAIN THE GIVEN PRESSURE, NOTIFY THE ENGINEER BEFORE PROCEEDING ANY FURTHER. "LEAN MIX CONCRETE" 10MPa IS RECOMMENDED FILL MATERIAL WHEN ENCOUNTERING AND REQUIRING TO REMOVE AND REPLACE SOFT SPOTS.

4. EARTH BOTTOMS OF EXCAVATIONS TO BE DRY, COMPETENT SOIL, LEVEL AND FREE FROM LOOSE OR ORGANIC MATTER, PROTECT BOTTOMS OF EXCAVATIONS FROM SOFTENING. SHOULD SOFTENING OCCUR, REMOVE SOFTENED SOIL, AND REPLACE WITH CONCRETE.

5. BOTTOM OF FOOTING MUST EXTEND BELOW LOCAL FROST LINE.
   WINDSOR - 1,200mm (4'-0")

6. ALL EXCAVATIONS MUST BE CARRIED OUT IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS OF ONTARIO. EXCAVATED SLOPES SHOULD BE EROSION PROTECTED DURING TIME OF CONSTRUCTION

7. THE ENGINEER SHALL INSPECT THE EXCAVATIONS BEFORE PROCEEDING WITH THE FOUNDATIONS.

8. MINIMUM REQUIRED ALLOWABLE SOIL BEARING CAPACITY – 2000 PSF (96 kPa).

9. PROVIDE POSITIVE DRAINAGE AWAY FROM FOUNDATIONS,

CONCRETE NOTES:

1. ALL CONCRETE WORK SHALL CONFORM TO THE LATEST REQUIREMENTS OF CSA-CAN-A23.1 CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION AND A23.3 DESIGN OF CONCRETE STRUCTURES.

2. CONCRETE SHALL BE MINIMUM 28 DAY COMPRESSIVE STRENGTH 20 MPa, CLASS F2, AIR ENTRAINED WITH A TOTAL AIR CONTENT OF 4% TO 7%.

3. CONCRETE REINFORCING STEEL SHALL BE NEW DEFORMED BARS CONFORMING TO CSA-G30.18 HAVING A MINIMUM YIELD STRENGTH OF 400 MPa. WELDED STEEL WIRE MESH SHALL COMPLY WITH CSA STANDARD G30.5M.

4. MINIMUM CONCRETE COVER FOR THE REINFORCING STEEL SHALL BE AS FOLLOWS:
   FOOTING 40mm (1 1/2") FROM TOP TO MAIN STEEL, 75mm (3") TO EARTH

5. USE SULPHATE RESISTANT CEMENT UNLESS PROVEN BY THE TEST THAT THE SULPHATE CONTENT OF SOIL IS WITHIN THE ALLOWABLE LIMITS.

6. ALL EXPOSED CORNERS OF CONCRETE SHALL HAVE 20mm (3/4") CHAMFER.

7. ANCHOR BOLTS SHALL CONFORM TO THE CSA STANDARD CAN/CSA-G40.21-92,
   MIN. Fu = 689 MPa (100,000 psi) AND SHALL BE SET TRUE AS TO LOCATION, ELEVATION AND PROJECTION TO THE FOLLOWING TOLERANCES:
   ANCHOR BOLT LOCATION : 3mm (1/8 in.)
   ANCHOR BOLT PROJECTION : 6mm (1/4 in.)

8. GROUT SHALL BE 55 MPa AT 28 DAYS, INSTALLED TO MANUFACTURERS WRITTEN INSTRUCTIONS.

9. MAXIMUM SLUMP IN CONCRETE FOR FOOTINGS SHALL BE 100mm (4").

10. ALL CONCRETE SHALL BE MECHANICALLY VIBRATED.

4. ALL CONCRETE SHALL BE PLACED IN ACCORDANE WITH CSA A23.3-04. ALL CONCRETE SHALL BE VIBRATED WITH MINIMUM 2.5" (64mm) VIBRATORS IN GOOD WORKING ORDER.

5. ALL CONCRETE SHALL BE PROTECTED FROM FREEZING FOR A MINIMUM OF 3 DAYS AFTER PLACEMENT.

6. NO CONCRETE SHALL BE PLACED WITHOUT WRITTEN APPROVAL FROM THE ENGINEER OR HIS REPRESENTATIVE.

7. REINFORCEMENT SHALL BE SUPPORTED TO OBTAIN BAR PLACEMENT AND SPACING AS INDICATED ON THE PLANS. PROVIDE & PLACE IN ACCORDANCE WITH RSIO MANUAL OF STANDARD PRACTICE.

9. ALL EXTERIOR BACKFILL TO BE COMPACTED TO 90% RELATIVE COMPACTION OUTSIDE OF SLURRY & SHALL CONSIST OF CLEAN GRANULAR MATERIAL. USE 10 MPa LEAN CONCRETE IF BACKFILL IS REQUIRED.

11. NO WELDING OF REINFORCEMENT STEEL OR ANCHOR BOLTS, UNLESS APPROVED BY THE ENGINEER.

Glos | Associates Inc.
ARCHITECTURAL + ENGINEERING CONSULTANTS

Project No: 08081
Date: 08/05/29
Issued for:
Sheet No: C101

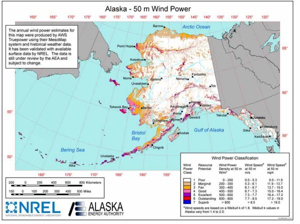
Project Name: 10 kW WIND TURBINE ON 16m HYDRAULIC TOWER

Client:

Sheet Title: FOUNDATION PLAN & DETAILS SECTION VIEW

Design By: -
Drawn By: J. GIBSON
Checked By: D. LUCIER

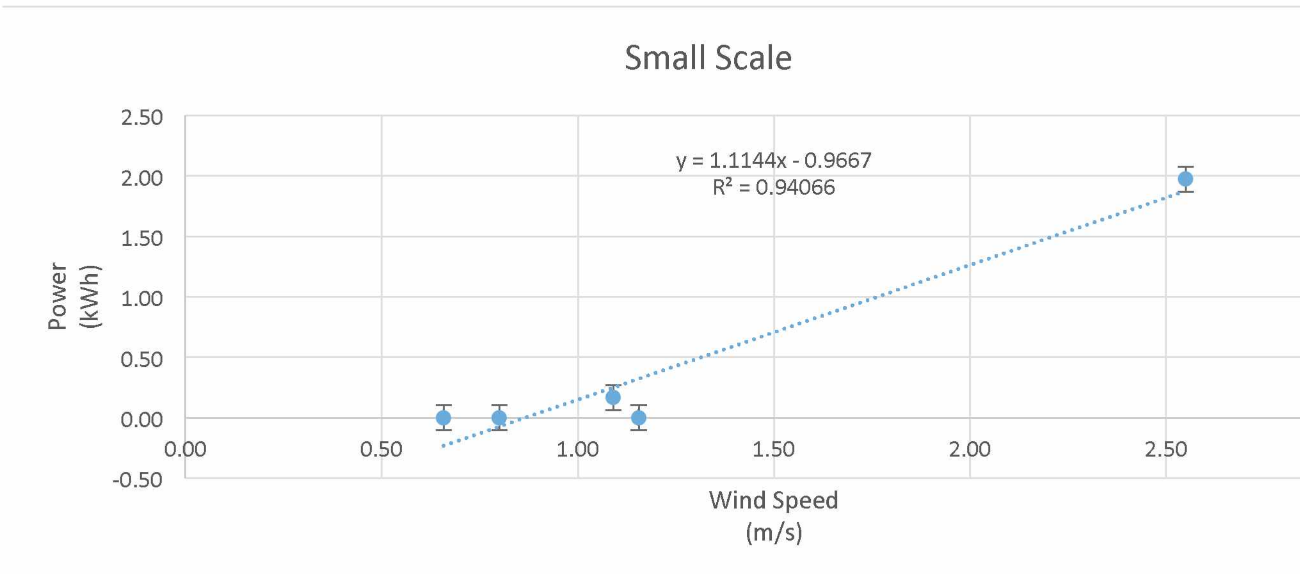
6/13/2007 2:33 PM


Alaska - 50 m Wind Power
The annual wind power estimates for this map were produced by AWS Truepower using their MesoMap system and historical weather data. It has been validated with available surface data by NREL. The data is still under review by the AEA and subject to change.
Arctic Ocean
Barrow
Point Hope
Kotzebue
Nome
Unalakleet
Galena
Nenana
Fairbanks
Tok
Bethel
Toksook Bay
Anchorage
Palmer
Valdez
Kenai
Homer
Seward
Dillingham
Yakutat
Juneau
Sitka
Petersburg
Ketchikan
Kodiak
Gulf of Alaska
Bristol Bay
Chignik
Bering Sea
Unalaska
Atka
Wind Power Classification
Wind Power Class
Resource Potential
Wind Power Density at 50 m W/m²
Wind Speed[a] at 50 m m/s
Wind Speed[a] at 50 m mph
1 Poor 0 - 200 0.0 - 5.3 0.0 - 11.9
2 Marginal 200 - 300 5.3 - 6.1 11.9 - 13.7
3 Fair 300 - 400 6.1 - 6.7 13.7 - 15.0
4 Good 400 - 500 6.7 - 7.3 15.0 - 16.4
5 Excellent 500 - 600 7.3 - 7.7 16.4 - 17.2
6 Outstanding 600 - 800 7.7 - 8.5 17.2 - 19.0
7 Superb > 800 > 8.5 > 19.0
[a]Wind speeds are based on a Weibull k of 1.8. Weibull k values in Alaska vary from 1.4 to 2.0.
200 0 200 400 600 800 Kilometers
100 0 100 200 300 400 500 Miles
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
ALASKA ENERGY AUTHORITY

Small Scale

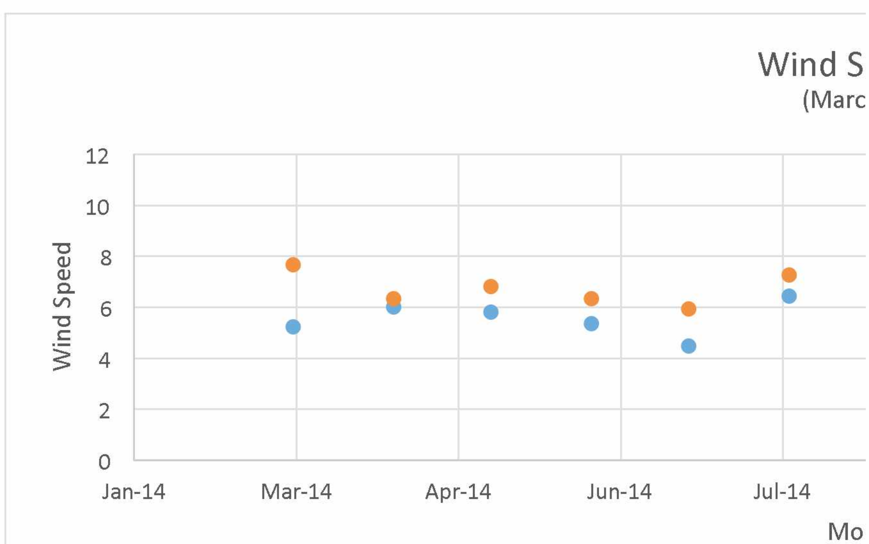
Month	Wind Speed (m/s)	Power (kWh)
Nov-14	1.09	0.17
Dec-14	1.16	0.00
Jan-15	0.66	0.00
Feb-15	0.80	0.00
Mar-15	2.55	1.97
5		2.14

0.97	Correlation Coef
0.08	Std Dev Power
0.24	Std Dev Wind
0.43	Mean Power
1.25	Mean Wind
4	DoF
0.05	α
0.103	95% CI Power
0.29	95% CI Wind



Healy Wind

Month	Wind Speed (m/s)
Mar-14	5.23
Apr-14	5.99
May-14	5.81
Jun-14	5.35
Jul-14	4.46
Aug-14	6.43
Sep-14	5.66
Oct-14	2.78
Nov-14	7.09
Dec-14	5.94
Jan-15	4.67
Feb-15	5.53
Mar-15	7.4



Large	y = 98247x - 199729	
98247		199729
Medium	y = 7.9151x - 22.173	
7.9151		22.1730
Small	y = 1.1163x - 0.9641	
1.1163		0.9641

	Eva Creek	
	Measured Scale	High Scale
January	384739.02	442107.80
February	599869.25	678354.24
March	732330.04	823816.79
April	566858.21	642102.99
May	536588.84	608862.51
June	454547.84	518768.74
July	409642.73	469455.94
August	454840.19	519089.78
September	515356.54	585546.15
October	512583.23	582500.61
November	418604.37	479297.21
December	507952.16	577414.99

EVA CREEK

Yearly Projected Power	6093912.42
$/kWh 1 year	$0.16
$/kWh 1 year w/o grant money	$0.15
$/kWh 10 year	$0.03
$/kWh 10 year w/o grant money	$0.03

DELTA

Yearly Projected Power	417.96
$/kWh 1 year	$45.62
$/kWh 1 year w/o grant money	$41.07
$/kWh 10 year	$16.25
$/kWh 10 year w/o grant money	$15.80

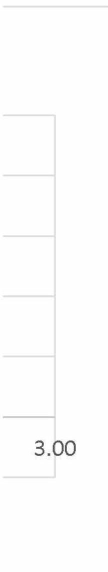
UAF

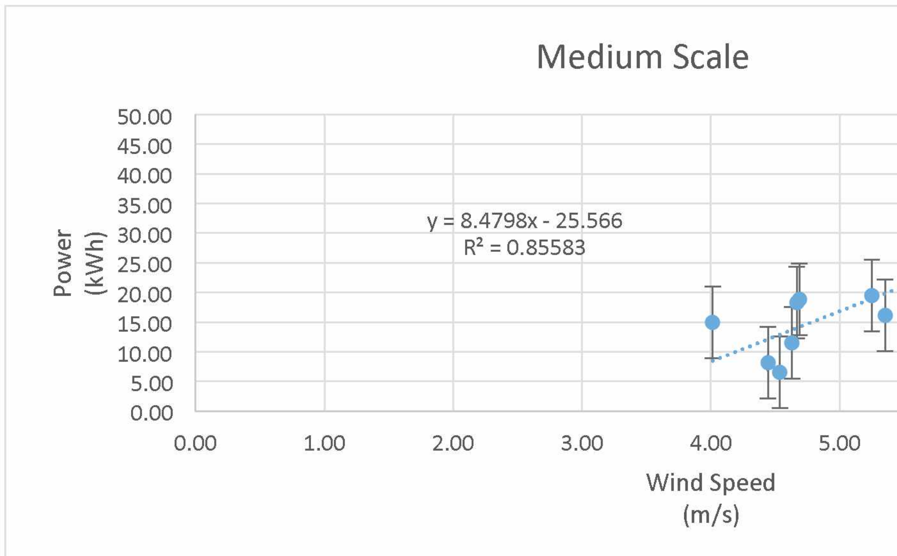
Yearly Projected Power	36.56
$/kWh 1 year	$24.65
$/kWh 1 year w/o grant money	$2.28
$/kWh 10 year	$4.52
$/kWh 10 year w/o grant money	$2.28

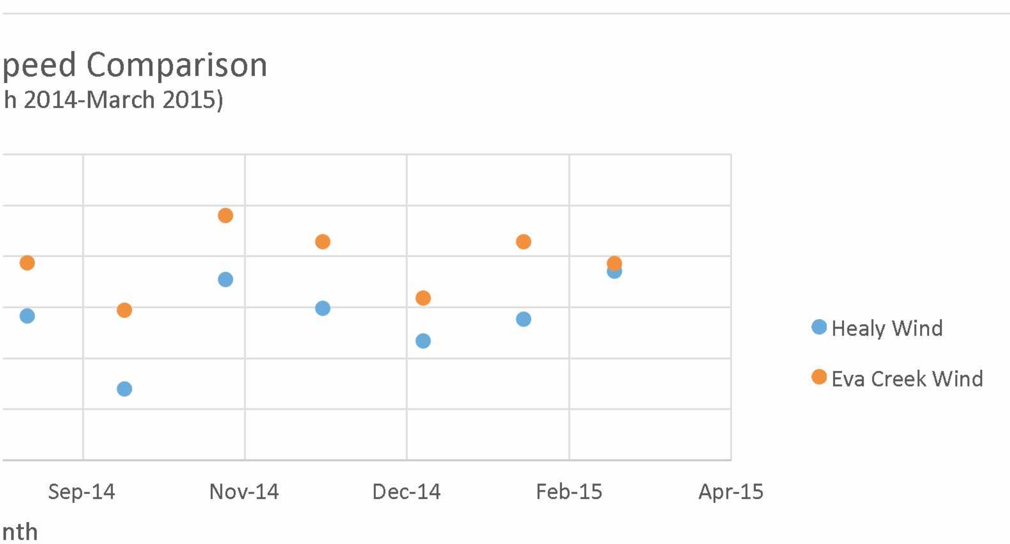

Ten Year Cost
$25.00
$20.00
$15.00
$10.00
$5.00
$0.00
Cost/kWh
$16.25
$4.52
$0.03
$14.00
$4.07
$0.03
$19.3
$0.04
Measured
High
Low
Confidence interval

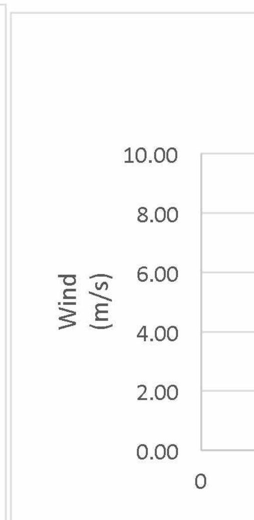
Medium Scale

Month	Wind Speed (m/s)	Power (kWh)
Mar-14	5.25	19.50
Apr-14	4.69	18.83
May-14	5.68	21.44
Jun-14	4.54	6.57
Jul-14	4.63	11.55
Aug-14	4.44	8.12
Sep-14	5.35	16.17
Oct-14	4.01	14.93
Nov-14	7.61	39.60
Dec-14	6.80	35.43
Jan-15	6.80	31.74
Feb-15	5.77	21.19
Mar-15	4.67	18.25
13		263.32







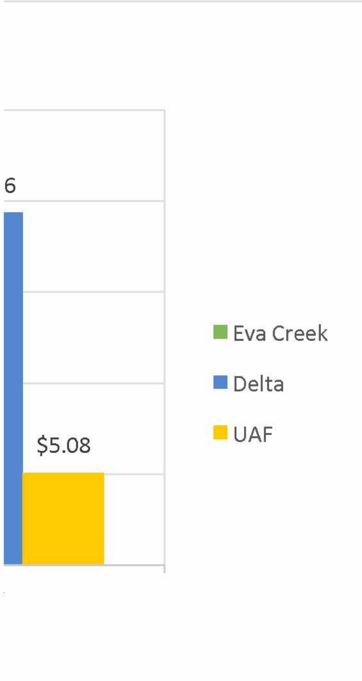


Projected Monthly Power Production (Scaled)				
	Delta			
Low Scale	Measured Scale	High Scale	Low Scale	Measured Scale
327370.25	24.91	29.54	20.29	5.68
521384.25	42.25	48.57	35.92	8.12
640843.28	52.92	60.29	45.55	9.63
491613.43	39.59	45.65	33.52	
464315.17	37.15	42.97	31.32	
390326.95	30.54	35.71	25.36	
349829.52	26.92	31.74	22.10	
390590.60	30.56	35.74	25.39	
445166.94	35.44	41.09	29.78	
442665.84	35.21	40.85	29.58	
357911.52	27.64	32.53	22.75	6.06
438489.34	34.84	40.44	29.24	7.08
				Ratio of months for UAF

6927317.74	5260507.09
$0.14	$0.18
$0.13	$0.18
$0.03	$0.04
$0.03	$0.04

485.10	350.82
$39.30	$54.35
$35.39	$48.93
$14.00	$19.36
$13.61	$18.82

40.62	32.50
$22.19	$27.73
$2.05	$2.56
$4.07	$5.08
$2.05	$2.56

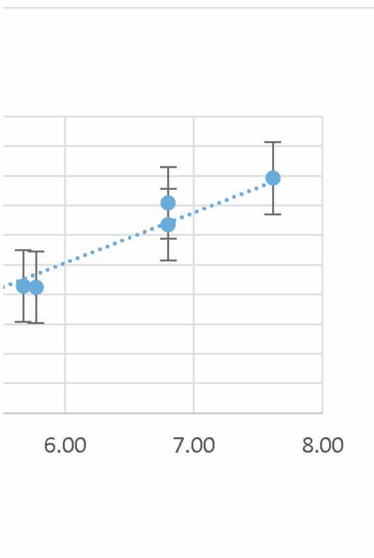

6
$5.08
Eva Creek
Delta
UAF

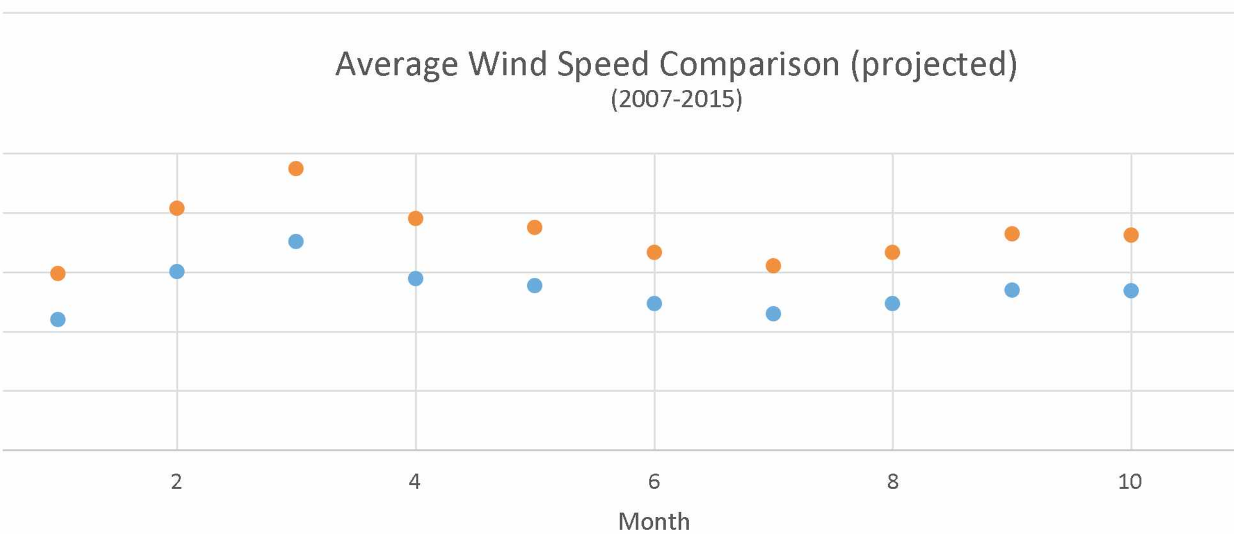

One Year Cost
$60.00
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
Cost/kWh
$45.62
$24.65
$0.16
$39.30
$22.19
$0.14
Measured
High
Confidence interval

L

0.93	Correlation Coef
10.00	Std Dev Power
1.09	Std Dev Wind
20.26	Mean Power
5.40	Mean Wind
12	DoF
0.05	α
6.044	95% CI Power
0.66	95% CI Wind

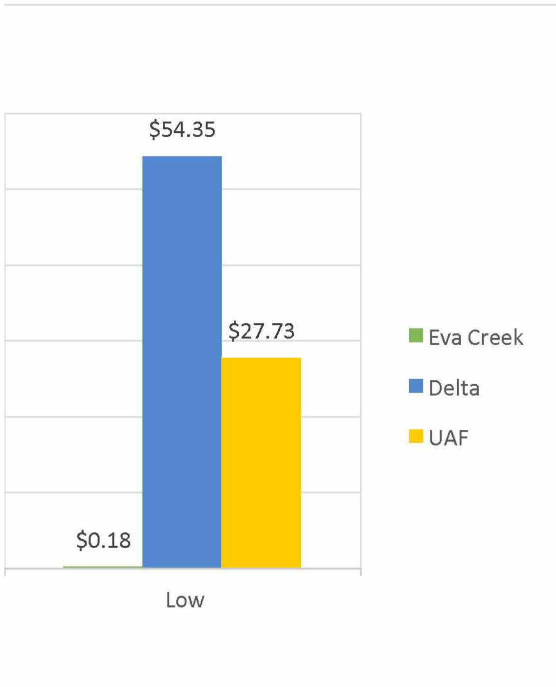
Month
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
13





		Healy	
UAF		Month	Avg Wind Speed (m/s)
High Scale	Low Scale		
6.33	5.02	January	4.40
9.01	7.23	February	6.02
10.67	8.59	March	7.02
		April	5.78
		May	5.55
		June	4.93
		July	4.59
		August	4.93
		September	5.39
		October	5.37
6.75	5.37	November	4.66
7.87	6.29	December	5.33

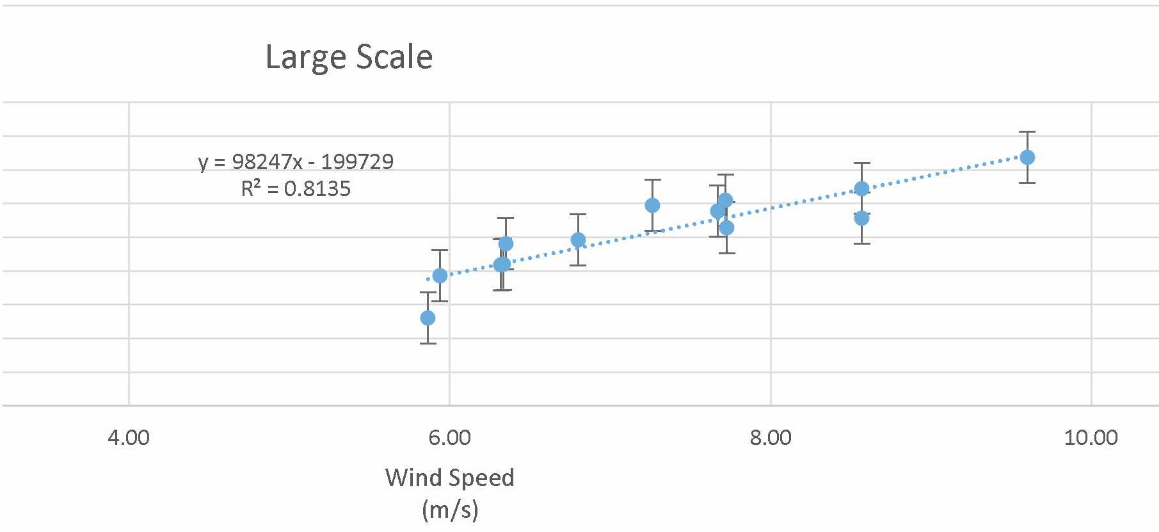
0.416666667

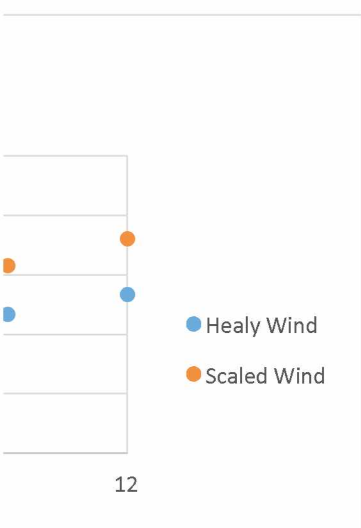

$54.35
$27.73
$0.18
Low
Eva Creek
Delta
UAF

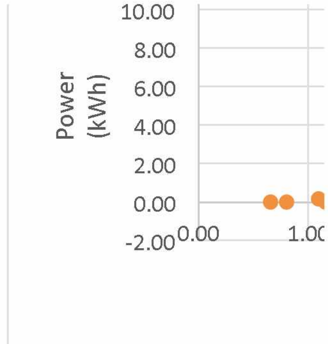
.arge Scale

Wind Speed (m/s)	Power (kWh)
7.67	578830.92
6.32	418979.92
6.80	491968.92
6.34	420306.75
5.94	385641.50
7.27	595086.75
7.73	528860.08
5.87	260169.50
9.60	737444.33
8.57	557119.33
6.35	480804.33
8.57	645451.58
7.72	609812.25
	6710476.17

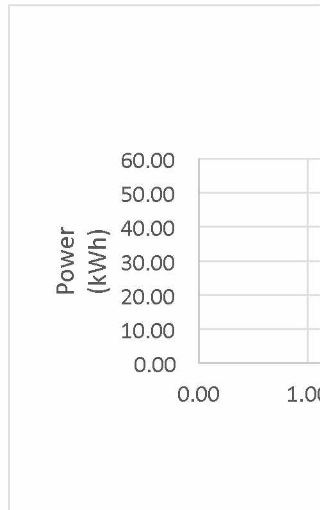
0.90	Correlation Coef
125659.29	Std Dev Power
1.15	Std Dev Wind
516190.47	Mean Power
7.29	Mean Wind
12.00	DoF
0.05	α
75935.15	95% CI Power
0.70	95% CI Wind

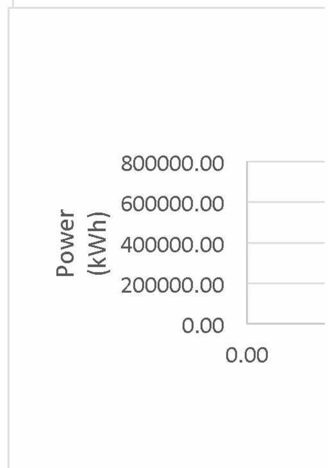




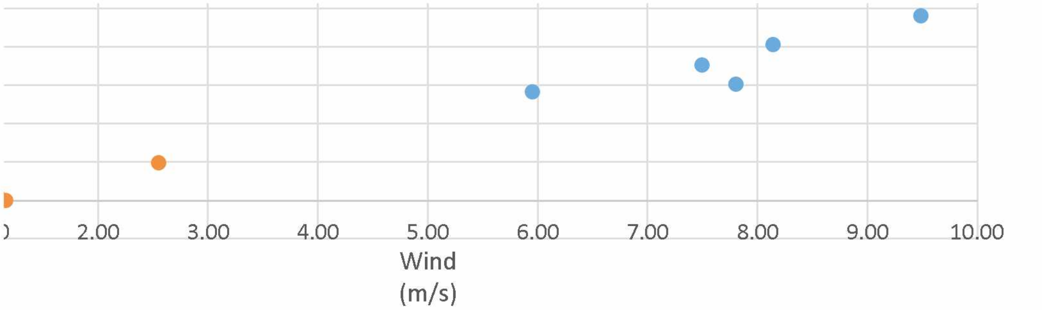


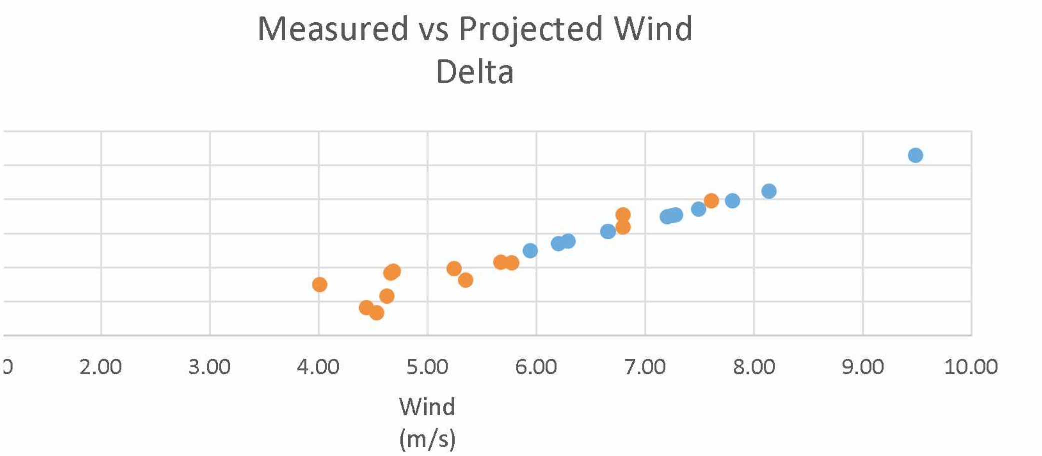
y 7 Year Monthly Wind Scaled		
Scale Measured	Scale High	Scale Low
5.95	6.53	5.37
8.14	8.94	7.34
9.49	10.42	8.56
7.80	8.57	7.04
7.49	8.23	6.76
6.66	7.31	6.01
6.20	6.81	5.59
6.66	7.32	6.01
7.28	7.99	6.56
7.25	7.96	6.54
6.29	6.91	5.68
7.20	7.91	6.50

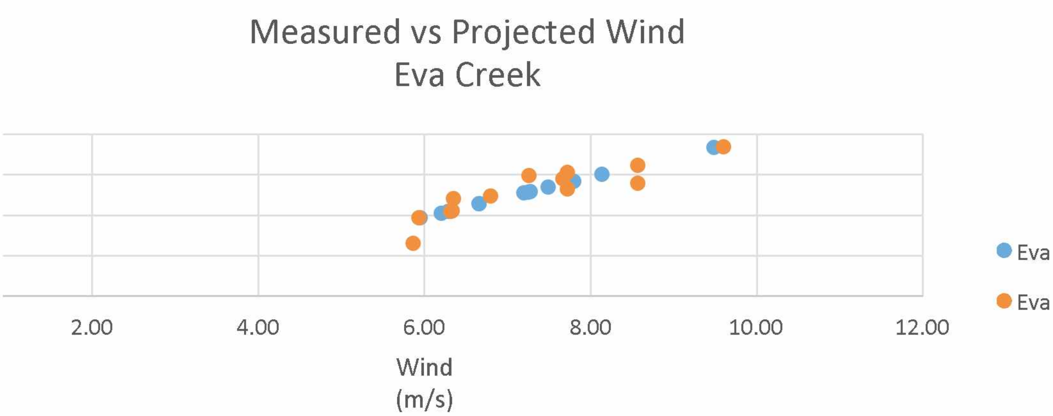




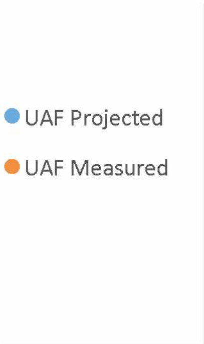
Month
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15


2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
Wind
(m/s)

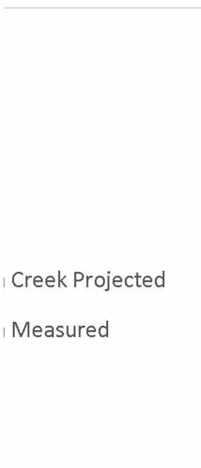

Measured vs Projected Wind
Delta
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
Wind
(m/s)


Measured vs Projected Wind
Eva Creek
2.00
4.00
6.00
8.00
10.00
12.00
Wind
(m/s)
Eva
Eva

Healy	Eva Creek		
Measured	Measured	E:H Ratio	High
5.23	7.67	1.47	8.37
5.99	6.32	1.06	7.02
5.81	6.80	1.17	7.50
5.35	6.34	1.18	7.03
4.46	5.94	1.33	6.64
6.43	7.27	1.13	7.96
5.66	7.73	1.37	8.42
2.78	5.87	2.11	6.56
7.09	9.60	1.35	10.30
5.94	8.57	1.44	9.27
4.67	6.35	1.36	7.05
5.53	8.57	1.55	9.27
7.4	7.72	1.04	8.42
	Scale Factor	1.35	


UAF Projected
UAF Measured


Delta Projected
Delta Measured


Creek Projected
Measured

Scale of Wind 2014-2015

Scaled			
High Ratio	Low	Low Ratio	Measured
1.60	6.97	1.33	5.25
1.17	5.62	0.94	4.69
1.29	6.10	1.05	5.68
1.31	5.64	1.05	4.54
1.49	5.24	1.18	4.63
1.24	6.57	1.02	4.44
1.49	7.03	1.24	5.35
2.36	5.17	1.86	4.01
1.45	8.90	1.26	7.61
1.56	7.87	1.33	6.80
1.51	5.65	1.21	6.80
1.68	7.87	1.42	5.77
1.14	7.02	0.95	4.67
1.48		1.22	

Delta Scaled					
Scaled	High	High Scaled	Low	Low Scaled	Measured
7.09	4.59	6.81	4.59	5.59	
6.33	4.03	5.98	4.69	5.71	
7.67	5.02	7.44	5.68	6.91	
6.13	3.88	5.75	4.54	5.53	
6.25	3.97	5.89	4.63	5.64	
6.00	3.78	5.61	4.44	5.41	
7.23	4.69	6.96	5.35	6.52	
5.42	3.36	4.98	4.01	4.89	
10.28	6.95	10.32	7.61	9.27	1.09
9.19	6.14	9.11	6.80	8.29	1.16
9.19	6.14	9.11	6.80	8.29	0.66
7.80	5.11	7.59	5.77	7.03	0.80
6.30	4.01	5.94	4.67	5.69	2.55
7.30		7.04		6.52	

UAF				
Scaled	High	High Scaled	Low	Low Scaled
1.47	1.38	2.05	0.80	0.97
1.56	1.45	2.15	0.86	1.05
0.89	0.95	1.41	0.37	0.45
1.08	1.09	1.62	0.51	0.62
3.44	2.84	4.22	2.26	2.75
1.69		2.29		1.17

Small Scale

Month	Wind Speed (m/s)	Power (kWh)	Month	Wind Speed (m/s)
Nov-14	2.77	1.5840	Nov	1.09
Nov-14	3.13	0.0532	Dec	1.16
Nov-14	1.12	0.0037	Jan	0.66
Nov-14	0.22	0.0018	Feb	0.80
Nov-14	0.54	0.0018	Mar	2.55
Nov-14	0.8	-0.0018		1.25
Nov-14	0.54	0.0018		
Nov-14	0.18	0.0037		
Nov-14	0.63	0.0128		
Nov-14	0.98	0.0018		
Dec-14	0.58	0.0000		
Dec-14	0.18	0.0018		
Dec-14	0.8	0.0000		
Dec-14	0.18	0.0000		
Dec-14	0.85	0.0018		
Dec-14	1.79	0.0000		
Dec-14	3.4	0.0018		
Dec-14	3	0.0018		
Dec-14	5.28	-0.0238		
Dec-14	3.26	0.0110		
Dec-14	1.74	0.0000		
Dec-14	0.45	0.0000		
Dec-14	0.56	0.0018		
Dec-14	0.45	0.0018		
Dec-14	1.12	0.0000		
Dec-14	0.49	0.0018		
Dec-14	0.67	0.0000		
Dec-14	0.45	0.0000		
Dec-14	0.89	0.0018		
Dec-14	0.67	0.0000		
Dec-14	0	0.0000		
Dec-14	0.31	0.0018		
Dec-14	0.18	0.0000		
Dec-14	0.45	0.0018		
Dec-14	1.34	0.0018		
Dec-14	1.83	-0.0018		
Dec-14	1.83	0.0018		
Dec-14	0.22	0.0018		
Dec-14	0.54	0.0000		
Jan-15	1.74	0.0000		
Jan-15	0.49	0.0000		
Jan-15	0	0.0000		
Jan-15	0.13	0.0018		
Jan-15	0.09	0.0000		

Jan-15	0.8	0.0018
Jan-15	0.72	0.0018
Jan-15	0.13	0.0000
Jan-15	0.31	0.0018
Jan-15	0.18	0.0000
Jan-15	1.12	0.0000
Jan-15	2.82	-0.0183
Jan-15	1.21	0.0055
Jan-15	1.03	0.0128
Jan-15	1.25	0.0037
Jan-15	0.31	-0.0018
Jan-15	0	0.0000
Jan-15	0.58	0.0018
Jan-15	0.04	0.0000
Jan-15	0.22	-0.0418
Feb-15	0.49	0.0080
Feb-15	0.89	0.0055
Feb-15	0.63	0.0037
Feb-15	0.54	-0.0183
Feb-15	1.3	0.0092
Feb-15	2.01	0.0073
Feb-15	0.22	0.0037
Feb-15	0.04	-0.0257
Feb-15	0.4	0.0128
Feb-15	1.07	0.0073
Feb-15	0.67	-0.0110
Feb-15	0.31	0.0110
Feb-15	0.27	0.0037
Feb-15	0.85	0.0037
Feb-15	0.27	-0.1320
Feb-15	1.12	0.1173
Feb-15	1.12	0.0073
Feb-15	0.85	0.0000
Feb-15	0.27	0.0037
Feb-15	0.76	0.0037
Feb-15	2.73	-0.0202
Mar-15	2.55	1.9727
	TOTAL kWh	**3.6145**

Date Time	Date	Battery Average	Speed Average (r	Power Available
11/21/14 22:05		12		5.28
11/21/14 22:05	Nov-14	56.4	2.77	24.82
11/21/14 23:05		55.3		24.33
11/22/14 0:05		57.6		25.34
11/22/14 1:05		55.1		24.24
11/22/14 2:05		54.9		24.16

11/22/14 3:05		54.9		24.16
11/22/14 4:05		55.2		24.29
11/22/14 5:05		57		25.08
11/22/14 6:05		57.7		25.39
11/22/14 7:05		55.9		24.60
11/22/14 8:05		55.4		24.38
11/22/14 9:05		56.4		24.82
11/22/14 10:05		55.8		24.55
11/22/14 11:05	Nov-14	55.6	3.13	24.46
11/22/14 12:05		55.3		24.33
11/22/14 13:05		55.2		24.29
11/22/14 14:05		54.9		24.16
11/22/14 15:05		54.9		24.16
11/22/14 16:05		54.8		24.11
11/22/14 17:05		54.8		24.11
11/22/14 18:05		54.8		24.11
11/22/14 19:05		54.8		24.11
11/22/14 20:05		54.8		24.11
11/22/14 21:05		54.7		24.07
11/22/14 22:05		54.7		24.07
11/22/14 23:05		54.7		24.07
11/23/14 0:05		54.7		24.07
11/23/14 1:05		54.7		24.07
11/23/14 2:05		54.7		24.07
11/23/14 3:05		54.7		24.07
11/23/14 4:05		54.6		24.02
11/23/14 5:05		54.7		24.07
11/23/14 6:05		54.6		24.02
11/23/14 7:05		54.9		24.16
11/23/14 8:05		54.8		24.11
11/23/14 9:05		54.8		24.11
11/23/14 10:05		54.7		24.07
11/23/14 11:05	Nov-14	54.6	1.12	24.02
11/23/14 12:05		54.6		24.02
11/23/14 13:05		54.6		24.02
11/23/14 14:05		54.6		24.02
11/23/14 15:05		54.6		24.02
11/23/14 16:05		54.6		24.02
11/23/14 17:05		54.6		24.02
11/23/14 18:05		54.6		24.02
11/23/14 19:05		54.6		24.02
11/23/14 20:05		54.6		24.02
11/23/14 21:05		54.6		24.02
11/23/14 22:05		54.6		24.02
11/23/14 23:05		54.6		24.02
11/24/14 0:05		54.5		23.98
11/24/14 1:05		54.6		24.02
11/24/14 2:05		54.6		24.02
11/24/14 3:05		54.5		23.98

11/24/14 4:05		54.5		23.98
11/24/14 5:05		54.5		23.98
11/24/14 6:05		54.5		23.98
11/24/14 7:05		54.5		23.98
11/24/14 8:05		54.5		23.98
11/24/14 9:05		54.5		23.98
11/24/14 10:05		54.5		23.98
11/24/14 11:05	Nov-14	54.5	0.22	23.98
11/24/14 12:05		54.5		23.98
11/24/14 13:05		54.5		23.98
11/24/14 14:05		54.5		23.98
11/24/14 15:05		54.4		23.94
11/24/14 16:05		54.4		23.94
11/24/14 17:05		54.4		23.94
11/24/14 18:05		54.4		23.94
11/24/14 19:05		54.4		23.94
11/24/14 20:05		54.4		23.94
11/24/14 21:05		54.4		23.94
11/24/14 22:05		54.4		23.94
11/24/14 23:05		54.4		23.94
11/25/14 0:05		54.4		23.94
11/25/14 1:05		54.4		23.94
11/25/14 2:05		54.4		23.94
11/25/14 3:05		54.4		23.94
11/25/14 4:05		54.4		23.94
11/25/14 5:05		54.4		23.94
11/25/14 6:05		54.4		23.94
11/25/14 7:05		54.4		23.94
11/25/14 8:05		54.4		23.94
11/25/14 9:05		54.4		23.94
11/25/14 10:05		54.4		23.94
11/25/14 11:05	Nov-14	54.4	0.54	23.94
11/25/14 12:05		54.3		23.89
11/25/14 13:05		54.3		23.89
11/25/14 14:05		54.3		23.89
11/25/14 15:05		54.3		23.89
11/25/14 16:05		54.3		23.89
11/25/14 17:05		54.3		23.89
11/25/14 18:05		54.3		23.89
11/25/14 19:05		54.3		23.89
11/25/14 20:05		54.3		23.89
11/25/14 21:05		54.3		23.89
11/25/14 22:05		54.3		23.89
11/25/14 23:05		54.3		23.89
11/26/14 0:05		54.3		23.89
11/26/14 1:05		54.3		23.89
11/26/14 2:05		54.3		23.89
11/26/14 3:05		54.3		23.89
11/26/14 4:05		54.3		23.89

11/26/14 5:05		54.3		23.89
11/26/14 6:05		54.3		23.89
11/26/14 7:05		54.3		23.89
11/26/14 8:05		54.3		23.89
11/26/14 9:05		54.3		23.89
11/26/14 10:05		54.3		23.89
11/26/14 11:05	Nov-14	54.3	0.8	23.89
11/26/14 12:05		54.3		23.89
11/26/14 13:05		54.3		23.89
11/26/14 14:05		54.3		23.89
11/26/14 15:05		54.3		23.89
11/26/14 16:05		54.3		23.89
11/26/14 17:05		54.3		23.89
11/26/14 18:05		54.3		23.89
11/26/14 19:05		54.3		23.89
11/26/14 20:05		54.3		23.89
11/26/14 21:05		54.3		23.89
11/26/14 22:05		54.3		23.89
11/26/14 23:05		54.3		23.89
11/27/14 0:05		54.4		23.94
11/27/14 1:05		54.4		23.94
11/27/14 2:05		54.3		23.89
11/27/14 3:05		54.4		23.94
11/27/14 4:05		54.4		23.94
11/27/14 5:05		54.4		23.94
11/27/14 6:05		54.4		23.94
11/27/14 7:05		54.4		23.94
11/27/14 8:05		54.3		23.89
11/27/14 9:05		54.3		23.89
11/27/14 10:05		54.3		23.89
11/27/14 11:05	Nov-14	54.3	0.54	23.89
11/27/14 12:05		54.3		23.89
11/27/14 13:05		54.3		23.89
11/27/14 14:05		54.3		23.89
11/27/14 15:05		54.3		23.89
11/27/14 16:05		54.3		23.89
11/27/14 17:05		54.3		23.89
11/27/14 18:05		54.3		23.89
11/27/14 19:05		54.3		23.89
11/27/14 20:05		54.3		23.89
11/27/14 21:05		54.3		23.89
11/27/14 22:05		54.3		23.89
11/27/14 23:05		54.3		23.89
11/28/14 0:05		54.3		23.89
11/28/14 1:05		54.3		23.89
11/28/14 2:05		54.3		23.89
11/28/14 3:05		54.3		23.89
11/28/14 4:05		54.3		23.89
11/28/14 5:05		54.3		23.89

11/28/14 6:05		54.3		23.89
11/28/14 7:05		54.3		23.89
11/28/14 8:05		54.3		23.89
11/28/14 9:05		54.3		23.89
11/28/14 10:05		54.3		23.89
11/28/14 11:05	Nov-14	54.3	0.18	23.89
11/28/14 12:05		54.3		23.89
11/28/14 13:05		54.3		23.89
11/28/14 14:05		54.3		23.89
11/28/14 15:05		54.2		23.85
11/28/14 16:05		54.2		23.85
11/28/14 17:05		54.2		23.85
11/28/14 18:05		54.2		23.85
11/28/14 19:05		54.2		23.85
11/28/14 20:05		54.2		23.85
11/28/14 21:05		54.2		23.85
11/28/14 22:05		54.2		23.85
11/28/14 23:05		54.2		23.85
11/29/14 0:05		54.1		23.80
11/29/14 1:05		54.1		23.80
11/29/14 2:05		53.9		23.72
11/29/14 3:05		53.9		23.72
11/29/14 4:05		53.9		23.72
11/29/14 5:05		53.5		23.54
11/29/14 6:05		53.5		23.54
11/29/14 7:05		53.4		23.50
11/29/14 8:05		53.4		23.50
11/29/14 9:05		53.4		23.50
11/29/14 10:05		53.4		23.50
11/29/14 11:05	Nov-14	53.4	0.63	23.50
11/29/14 12:05		53.4		23.50
11/29/14 13:05		53.4		23.50
11/29/14 14:05		53.4		23.50
11/29/14 15:05		53.4		23.50
11/29/14 16:05		53.4		23.50
11/29/14 17:05		53.4		23.50
11/29/14 18:05		53.4		23.50
11/29/14 19:05		53.4		23.50
11/29/14 20:05		53.4		23.50
11/29/14 21:05		53.4		23.50
11/29/14 22:05		53.4		23.50
11/29/14 23:05		53.4		23.50
11/30/14 0:05		53.4		23.50
11/30/14 1:05		53.4		23.50
11/30/14 2:05		53.4		23.50
11/30/14 3:05		53.4		23.50
11/30/14 4:05		53.4		23.50
11/30/14 5:05		53.4		23.50
11/30/14 6:05		53.4		23.50

11/30/14 7:05		53.4		23.50
11/30/14 8:05		53.4		23.50
11/30/14 9:05		53.4		23.50
11/30/14 10:05		53.4		23.50
11/30/14 11:05		53.4		23.50
11/30/14 12:05	Nov-14	53.4	0.98	23.50
11/30/14 13:05		53.3		23.45
11/30/14 14:05		53.3		23.45
11/30/14 15:05		53.3		23.45
11/30/14 15:06		53.3		23.45
11/30/14 16:06		53.3		23.45
11/30/14 17:06		53.3		23.45
11/30/14 18:06		53.3		23.45
11/30/14 19:06		53.3		23.45
11/30/14 20:06		53.3		23.45
11/30/14 21:06		53.3		23.45
11/30/14 22:06		53.3		23.45
11/30/14 23:06		53.3		23.45
12/1/14 0:06		53.3		23.45
12/1/14 1:06		53.3		23.45
12/1/14 2:06		53.3		23.45
12/1/14 3:06		53.3		23.45
12/1/14 4:06		53.4		23.50
12/1/14 5:06		53.4		23.50
12/1/14 6:06		53.4		23.50
12/1/14 7:06		53.4		23.50
12/1/14 8:06		53.4		23.50
12/1/14 9:06		53.4		23.50
12/1/14 10:06		53.4		23.50
12/1/14 11:06	Dec-14	53.4	0.58	23.50
12/1/14 12:06		53.4		23.50
12/1/14 13:06		53.4		23.50
12/1/14 14:06		53.4		23.50
12/1/14 15:06		53.3		23.45
12/1/14 16:06		53.3		23.45
12/1/14 17:06		53.3		23.45
12/1/14 18:06		53.3		23.45
12/1/14 19:06		53.3		23.45
12/1/14 20:06		53.3		23.45
12/1/14 21:06		53.3		23.45
12/1/14 22:06		53.3		23.45
12/1/14 23:06		53.3		23.45
12/2/14 0:06		53.3		23.45
12/2/14 1:06		53.3		23.45
12/2/14 2:06		53.2		23.41
12/2/14 3:06		53.2		23.41
12/2/14 4:06		53.2		23.41
12/2/14 5:06		53.2		23.41
12/2/14 6:06		53.2		23.41

12/2/14 7:06		53.2		23.41
12/2/14 8:06		53.2		23.41
12/2/14 9:06		53.2		23.41
12/2/14 10:06		53.2		23.41
12/2/14 11:06	Dec-14	53.2	0.18	23.41
12/2/14 12:06		53.2		23.41
12/2/14 13:06		53.2		23.41
12/2/14 14:06		53.2		23.41
12/2/14 15:06		53.2		23.41
12/2/14 16:06		53.2		23.41
12/2/14 17:06		53.2		23.41
12/2/14 18:06		53.2		23.41
12/2/14 19:06		53.2		23.41
12/2/14 20:06		53.2		23.41
12/2/14 21:06		53.2		23.41
12/2/14 22:06		53.2		23.41
12/2/14 23:06		53.2		23.41
12/3/14 0:06		53.2		23.41
12/3/14 1:06		53.2		23.41
12/3/14 2:06		53.2		23.41
12/3/14 3:06		53.2		23.41
12/3/14 4:06		53.2		23.41
12/3/14 5:06		53.2		23.41
12/3/14 6:06		53.2		23.41
12/3/14 7:06		53.2		23.41
12/3/14 8:06		53.2		23.41
12/3/14 9:06		53.2		23.41
12/3/14 10:06		53.2		23.41
12/3/14 11:06	Dec-14	53.2	0.8	23.41
12/3/14 12:06		53.2		23.41
12/3/14 13:06		53.1		23.36
12/3/14 14:06		53.1		23.36
12/3/14 15:06		53.1		23.36
12/3/14 16:06		53.1		23.36
12/3/14 17:06		53.1		23.36
12/3/14 18:06		53.1		23.36
12/3/14 19:06		53.2		23.41
12/3/14 20:06		53.1		23.36
12/3/14 21:06		53.1		23.36
12/3/14 22:06		53.1		23.36
12/3/14 23:06		53.2		23.41
12/4/14 0:06		53.2		23.41
12/4/14 1:06		53.2		23.41
12/4/14 2:06		53.2		23.41
12/4/14 3:06		53.2		23.41
12/4/14 4:06		53.2		23.41
12/4/14 5:06		53.2		23.41
12/4/14 6:06		53.2		23.41
12/4/14 7:06		53.2		23.41

12/4/14 8:06		53.2		23.41
12/4/14 9:06		53.2		23.41
12/4/14 10:06		53.2		23.41
12/4/14 11:06	Dec-14	53.2	0.18	23.41
12/4/14 12:06		53.2		23.41
12/4/14 13:06		53.2		23.41
12/4/14 14:06		53.2		23.41
12/4/14 15:06		53.2		23.41
12/4/14 16:06		53.2		23.41
12/4/14 17:06		53.2		23.41
12/4/14 18:06		53.2		23.41
12/4/14 19:06		53.2		23.41
12/4/14 20:06		53.2		23.41
12/4/14 21:06		53.2		23.41
12/4/14 22:06		53.2		23.41
12/4/14 23:06		53.2		23.41
12/5/14 0:06		53.2		23.41
12/5/14 1:06		53.2		23.41
12/5/14 2:06		53.2		23.41
12/5/14 3:06		53.2		23.41
12/5/14 4:06		53.2		23.41
12/5/14 5:06		53.2		23.41
12/5/14 6:06		53.2		23.41
12/5/14 7:06		53.2		23.41
12/5/14 8:06		53.2		23.41
12/5/14 9:06		53.2		23.41
12/5/14 10:06		53.2		23.41
12/5/14 11:06	Dec-14	53.2	0.85	23.41
12/5/14 12:06		53.2		23.41
12/5/14 13:06		53.2		23.41
12/5/14 14:06		53.2		23.41
12/5/14 15:06		53.1		23.36
12/5/14 16:06		53.1		23.36
12/5/14 17:06		53.1		23.36
12/5/14 18:06		53.1		23.36
12/5/14 19:06		53.1		23.36
12/5/14 20:06		53.1		23.36
12/5/14 21:06		53.1		23.36
12/5/14 22:06		53.1		23.36
12/5/14 23:06		53.1		23.36
12/6/14 0:06		53.1		23.36
12/6/14 1:06		53.1		23.36
12/6/14 2:06		53.1		23.36
12/6/14 3:06		53.1		23.36
12/6/14 4:06		53.1		23.36
12/6/14 5:06		53.1		23.36
12/6/14 6:06		53.1		23.36
12/6/14 7:06		53.1		23.36
12/6/14 8:06		53.1		23.36

12/6/14 9:06		53.1		23.36
12/6/14 10:06		53.1		23.36
12/6/14 11:06	Dec-14	53.1	1.79	23.36
12/6/14 12:06		53.1		23.36
12/6/14 13:06		53.1		23.36
12/6/14 14:06		53.1		23.36
12/6/14 15:06		53.1		23.36
12/6/14 16:06		53.1		23.36
12/6/14 17:06		53.1		23.36
12/6/14 18:06		53.1		23.36
12/6/14 19:06		53.1		23.36
12/6/14 20:06		53.1		23.36
12/6/14 21:06		53.1		23.36
12/6/14 22:06		53.1		23.36
12/6/14 23:06		53.1		23.36
12/7/14 0:06		53.1		23.36
12/7/14 1:06		53.1		23.36
12/7/14 2:06		53.1		23.36
12/7/14 3:06		53.1		23.36
12/7/14 4:06		53.1		23.36
12/7/14 5:06		53.1		23.36
12/7/14 6:06		53.1		23.36
12/7/14 7:06		53.1		23.36
12/7/14 8:06		53.1		23.36
12/7/14 9:06		53.1		23.36
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12/7/14 11:06	Dec-14	53.1	3.4	23.36
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12/8/14 21:06		52.9		23.28
12/8/14 22:06		52.9		23.28
12/8/14 23:06		52.9		23.28
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12/9/14 2:06		53		23.32
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12/9/14 9:06		52.9		23.28
12/9/14 10:06		52.9		23.28
12/9/14 11:06	Dec-14	56.1	5.28	24.68
12/9/14 12:06		55.5		24.42
12/9/14 13:06		54		23.76
12/9/14 14:06		53.8		23.67
12/9/14 15:06		53.7		23.63
12/9/14 16:06		54.3		23.89
12/9/14 17:06		55		24.20
12/9/14 18:06		55.6		24.46
12/9/14 19:06		56		24.64
12/9/14 20:06		55.8		24.55
12/9/14 21:06		54.6		24.02
12/9/14 22:06		56.1		24.68
12/9/14 23:06		55.4		24.38
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12/10/14 2:06		54		23.76
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12/10/14 5:06		54		23.76
12/10/14 6:06		53.8		23.67
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12/10/14 9:06		53.8		23.67
12/10/14 10:06		53.8		23.67

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12/10/14 13:06		53.7		23.63
12/10/14 14:06		53.7		23.63
12/10/14 15:06		54		23.76
12/10/14 16:06		54.2		23.85
12/10/14 17:06		54.9		24.16
12/10/14 18:06		54		23.76
12/10/14 19:06		53.8		23.67
12/10/14 20:06		53.7		23.63
12/10/14 21:06		53.7		23.63
12/10/14 22:06		53.6		23.58
12/10/14 23:06		53.6		23.58
12/11/14 0:06	Dec-14	53.6	1.74	23.58
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12/11/14 2:06		55.4		24.38
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12/11/14 8:06		54		23.76
12/11/14 9:05		53.9		23.72
12/11/14 10:05		54.1		23.80
12/11/14 11:05		53.9		23.72
12/11/14 12:05		53.8		23.67
12/11/14 13:05		53.7		23.63
12/11/14 14:05		53.7		23.63
12/11/14 15:05		53.7		23.63
12/11/14 16:05		53.7		23.63
12/11/14 17:05		53.7		23.63
12/11/14 18:05		53.7		23.63
12/11/14 19:05		53.6		23.58
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12/11/14 22:05		53.6		23.58
12/11/14 23:05		53.6		23.58
12/12/14 0:05	Dec-14	53.6	0.49	23.58
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12/12/14 9:05		53.6		23.58
12/12/14 10:05		53.6		23.58
12/12/14 11:05		53.6		23.58

12/12/14 12:05	Dec-14	53.6	0.49	23.58
12/12/14 13:05		53.5		23.54
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12/13/14 3:05		53.5		23.54
12/13/14 4:05		53.5		23.54
12/13/14 5:05		53.5		23.54
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12/13/14 11:05	Dec-14	53.5	0.45	23.54
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12/13/14 20:05		53.5		23.54
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12/15/14 9:05		53.3		23.45
12/15/14 10:05		53.3		23.45
12/15/14 11:05	Dec-14	53.3	0.45	23.45
12/15/14 12:05		53.3		23.45
12/15/14 13:05		53.3		23.45
12/15/14 14:05		53.3		23.45
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12/15/14 22:05		53.4		23.50
12/15/14 23:05		53.4		23.50
12/16/14 0:05		53.3		23.45
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12/16/14 3:05		53.3		23.45
12/16/14 4:05		53.3		23.45
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12/16/14 9:05		53.3		23.45
12/16/14 10:05		53.3		23.45
12/16/14 11:05	Dec-14	53.3	1;12	23.45
12/16/14 12:05		53.3		23.45
12/16/14 13:05		53.3		23.45

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12/16/14 15:05		53.3		23.45
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12/16/14 22:05		53.3		23.45
12/16/14 23:05		53.3		23.45
12/17/14 0:05		53.3		23.45
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12/17/14 4:05		53.3		23.45
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12/17/14 9:05		53.3		23.45
12/17/14 10:05		53.2		23.41
12/17/14 11:05	Dec-14	53.2	0.49	23.41
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12/17/14 17:05		53.2		23.41
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12/17/14 20:05		53.2		23.41
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12/17/14 23:05		53.2		23.41
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12/18/14 2:05		53.2		23.41
12/18/14 3:05		53.2		23.41
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12/18/14 7:05		53.2		23.41
12/18/14 8:05		53.2		23.41
12/18/14 9:05		53.2		23.41
12/18/14 10:05		53.2		23.41
12/18/14 11:05	Dec-14	53.2	0.67	23.41
12/18/14 12:05		53.2		23.41
12/18/14 13:05		53.3		23.45
12/18/14 14:05		53.2		23.41

12/18/14 15:05		53.2		23.41
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12/18/14 21:05		53.2		23.41
12/18/14 22:05		53.2		23.41
12/18/14 23:05		53.2		23.41
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12/19/14 1:05		53.2		23.41
12/19/14 2:05		53.2		23.41
12/19/14 3:05		53.2		23.41
12/19/14 4:05		53.2		23.41
12/19/14 5:05		53.2		23.41
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12/19/14 9:05		53.2		23.41
12/19/14 10:05		53.2		23.41
12/19/14 11:05	Dec-14	53.2	0.45	23.41
12/19/14 12:05		53.2		23.41
12/19/14 13:05		53.2		23.41
12/19/14 14:05		53.2		23.41
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12/19/14 20:05		53.2		23.41
12/19/14 21:05		53.2		23.41
12/19/14 22:05		53.2		23.41
12/19/14 23:05		53.2		23.41
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12/20/14 5:05		53.2		23.41
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12/20/14 9:05		53.2		23.41
12/20/14 10:05		53.2		23.41
12/20/14 11:05	Dec-14	53.2	0.89	23.41
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12/20/14 23:05		53.2		23.41
12/21/14 0:05		53.1		23.36
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12/21/14 9:05		53.1		23.36
12/21/14 10:05		53.2		23.41
12/21/14 11:05	Dec-14	53.2	0.67	23.41
12/21/14 12:05		53.2		23.41
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12/21/14 19:05		53.1		23.36
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12/21/14 23:05		53.1		23.36
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12/22/14 1:05		53.1		23.36
12/22/14 2:05		53.1		23.36
12/22/14 3:05		53.1		23.36
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12/22/14 5:05		53.1		23.36
12/22/14 6:05		53.1		23.36
12/22/14 7:05		53.1		23.36
12/22/14 8:05		52.8		23.23
12/22/14 9:05		53		23.32
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12/22/14 11:05	Dec-14	53.1	0	23.36
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12/22/14 14:05		53.1		23.36
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12/23/14 9:05		53		23.32
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12/23/14 11:05	Dec-14	53	0.31	23.32
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12/24/14 9:05		53		23.32
12/24/14 10:05		53		23.32
12/24/14 11:05	Dec-14	53	0.18	23.32
12/24/14 12:05		53		23.32
12/24/14 13:05		53		23.32
12/24/14 14:05		53		23.32
12/24/14 15:05		53		23.32
12/24/14 16:05		53		23.32
12/24/14 17:05		53		23.32

12/24/14 18:05		53		23.32
12/24/14 19:05		53		23.32
12/24/14 20:05		53		23.32
12/24/14 21:05		53		23.32
12/24/14 22:05		53		23.32
12/24/14 23:05		53		23.32
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12/25/14 2:05		53		23.32
12/25/14 3:05		52.9		23.28
12/25/14 4:05		52.9		23.28
12/25/14 5:05		53		23.32
12/25/14 6:05		53		23.32
12/25/14 7:05		53		23.32
12/25/14 8:05		53		23.32
12/25/14 9:05		53		23.32
12/25/14 10:05		53		23.32
12/25/14 11:05	Dec-14	53	0.45	23.32
12/25/14 12:05		52.9		23.28
12/25/14 13:05		52.9		23.28
12/25/14 14:05		52.9		23.28
12/25/14 15:05		52.9		23.28
12/25/14 16:05		52.9		23.28
12/25/14 17:05		52.9		23.28
12/25/14 18:05		52.9		23.28
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12/25/14 20:05		52.9		23.28
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12/25/14 23:05		52.9		23.28
12/26/14 0:05		52.9		23.28
12/26/14 1:05		52.9		23.28
12/26/14 2:05		52.9		23.28
12/26/14 3:05		52.9		23.28
12/26/14 4:05		52.9		23.28
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12/26/14 8:05		52.9		23.28
12/26/14 9:05		52.9		23.28
12/26/14 10:05		52.9		23.28
12/26/14 11:05	Dec-14	52.9	1.34	23.28
12/26/14 12:05		52.9		23.28
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12/26/14 14:05		52.9		23.28
12/26/14 15:05		52.9		23.28
12/26/14 16:05		52.9		23.28
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12/26/14 18:05		52.9		23.28

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12/26/14 20:05		52.9		23.28
12/26/14 21:05		52.8		23.23
12/26/14 22:05		52.8		23.23
12/26/14 23:05		52.8		23.23
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12/27/14 1:05		52.9		23.28
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12/27/14 4:05		52.9		23.28
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12/27/14 7:05		52.9		23.28
12/27/14 8:05		52.9		23.28
12/27/14 9:05		52.9		23.28
12/27/14 10:05		52.9		23.28
12/27/14 11:05	Dec-14	52.9	1.83	23.28
12/27/14 12:05		52.9		23.28
12/27/14 13:05		52.9		23.28
12/27/14 14:05		52.9		23.28
12/27/14 15:05		52.9		23.28
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12/28/14 9:05		52.8		23.23
12/28/14 10:05		52.8		23.23
12/28/14 11:05	Dec-14	52.8	1.83	23.23
12/28/14 12:05		52.8		23.23
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12/28/14 23:05		52.8		23.23
12/29/14 0:05		52.8		23.23
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12/29/14 3:05		52.8		23.23
12/29/14 4:05		52.8		23.23
12/29/14 5:05		52.8		23.23
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12/29/14 8:05		52.8		23.23
12/29/14 9:05		52.8		23.23
12/29/14 10:05		52.8		23.23
12/29/14 11:05	Dec-14	52.8	0.22	23.23
12/29/14 12:05		52.8		23.23
12/29/14 13:05		52.8		23.23
12/29/14 14:05		52.8		23.23
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12/29/14 16:05		52.7		23.19
12/29/14 17:05		52.7		23.19
12/29/14 18:05		52.7		23.19
12/29/14 19:05		52.7		23.19
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12/30/14 0:05		52.7		23.19
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12/30/14 7:05	Dec-14	52.7	0.54	23.19
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12/30/14 10:05		52.7		23.19
12/30/14 11:05		52.7		23.19
12/30/14 12:05		52.7		23.19
12/30/14 13:05		52.7		23.19
12/30/14 14:05		52.7		23.19
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1/2/15 18:06	Jan-15	52.7	1.74	23.19

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1/3/15 0:06		52.7		23.19
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1/3/15 17:06		52.7		23.19
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1/4/15 10:06		52.7		23.19
1/4/15 11:06		52.7		23.19
1/4/15 12:06	Jan-15	52.7	0	23.19
1/4/15 13:06		52.7		23.19
1/4/15 14:06		52.7		23.19
1/4/15 15:06		52.7		23.19
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1/4/15 18:06		52.7		23.19
1/4/15 19:06		52.7		23.19

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1/5/15 11:06		52.7		23.19
1/5/15 12:06	Jan-15	52.7	0.13	23.19
1/5/15 13:06		52.7		23.19
1/5/15 14:06		52.7		23.19
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1/5/15 17:06		52.7		23.19
1/5/15 18:06		52.6		23.14
1/5/15 19:06		52.6		23.14
1/5/15 20:06		52.6		23.14
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1/5/15 22:06		52.6		23.14
1/5/15 23:06		52.6		23.14
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1/6/15 6:06		52.6		23.14
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1/6/15 10:06		52.6		23.14
1/6/15 11:06		52.6		23.14
1/6/15 12:06	Jan-15	52.6	0.09	23.14
1/6/15 13:06		52.6		23.14
1/6/15 14:06		52.6		23.14
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1/6/15 17:06		52.6		23.14
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1/6/15 19:06		52.6		23.14
1/6/15 20:06		52.6		23.14

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1/7/15 8:06		52.6		23.14
1/7/15 9:06		52.6		23.14
1/7/15 10:06		52.6		23.14
1/7/15 11:06	Jan-15	52.6	0.8	23.14
1/7/15 12:06		52.5		23.10
1/7/15 13:06		52.5		23.10
1/7/15 14:06		52.5		23.10
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1/7/15 23:06		52.5		23.10
1/8/15 0:06		52.5		23.10
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1/8/15 9:06		52.5		23.10
1/8/15 10:06		52.5		23.10
1/8/15 11:06	Jan-15	52.5	0.72	23.10
1/8/15 12:06		52.4		23.06
1/8/15 13:06		52.4		23.06
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1/8/15 16:06		52.4		23.06
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1/8/15 20:06		52.4		23.06
1/8/15 21:06		52.4		23.06

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1/8/15 23:06		52.4		23.06
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1/9/15 3:06		52.4		23.06
1/9/15 4:06		52.4		23.06
1/9/15 5:06		52.4		23.06
1/9/15 6:06		52.4		23.06
1/9/15 7:06		52.4		23.06
1/9/15 8:06		52.4		23.06
1/9/15 9:06		52.4		23.06
1/9/15 10:06		52.4		23.06
1/9/15 11:06		52.4		23.06
1/9/15 12:06	Jan-15	52.4	0.13	23.06
1/9/15 13:06		52.4		23.06
1/9/15 14:06		52.4		23.06
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1/9/15 17:06		52.4		23.06
1/9/15 18:06		52.4		23.06
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1/10/15 0:06		52.4		23.06
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1/10/15 2:06		52.4		23.06
1/10/15 3:06		52.4		23.06
1/10/15 4:06		52.4		23.06
1/10/15 5:06		52.4		23.06
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1/10/15 9:06		52.4		23.06
1/10/15 10:06		52.3		23.01
1/10/15 11:06		52.3		23.01
1/10/15 12:06	Jan-15	52.4	0.31	23.06
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1/10/15 14:06		52.3		23.01
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1/10/15 16:06		52.3		23.01
1/10/15 17:06		52.3		23.01
1/10/15 18:06		52.3		23.01
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1/10/15 22:06		52.3		23.01

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1/11/15 0:06	Jan-15	52.3	0.18	23.01
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1/11/15 3:06		52.3		23.01
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1/11/15 5:06		52.3		23.01
1/11/15 6:06		52.3		23.01
1/11/15 7:06		52.3		23.01
1/11/15 8:06		52.3		23.01
1/11/15 9:06		52.3		23.01
1/11/15 10:06		52.3		23.01
1/11/15 11:06		52.3		23.01
1/11/15 12:06		52.3		23.01
1/11/15 13:06		52.3		23.01
1/11/15 14:06		52.3		23.01
1/11/15 15:06		52.3		23.01
1/11/15 16:06		52.3		23.01
1/11/15 17:06		52.3		23.01
1/11/15 18:06		52.3		23.01
1/11/15 19:06		52.3		23.01
1/11/15 20:06		52.3		23.01
1/11/15 21:06		52.3		23.01
1/11/15 22:06		52.3		23.01
1/11/15 23:06		52.3		23.01
1/12/15 0:06	Jan-15	52.3	1.12	23.01
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1/12/15 2:06		52.3		23.01
1/12/15 3:06		52.3		23.01
1/12/15 4:06		52.3		23.01
1/12/15 5:06		52.3		23.01
1/12/15 6:06		52.3		23.01
1/12/15 7:06		52.3		23.01
1/12/15 8:06		52.3		23.01
1/12/15 9:06		52.3		23.01
1/12/15 10:06		52.3		23.01
1/12/15 11:06		52.2		22.97
1/12/15 12:06		52.2		22.97
1/12/15 13:06		52.2		22.97
1/12/15 14:06		52.2		22.97
1/12/15 15:06		52.2		22.97
1/12/15 16:06		52.2		22.97
1/12/15 17:06		52.2		22.97
1/12/15 18:06		52.2		22.97
1/12/15 19:06		52.2		22.97
1/12/15 20:06		52.2		22.97
1/12/15 21:06		52.2		22.97
1/12/15 22:06		52.2		22.97
1/12/15 23:06		52.3		23.01

1/13/15 0:06	Jan-15	52.3	2.82	23.01
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1/13/15 2:06		52.3		23.01
1/13/15 3:06		52.3		23.01
1/13/15 4:06		52.3		23.01
1/13/15 5:06		52.3		23.01
1/13/15 6:06		52.3		23.01
1/13/15 7:06		52.2		22.97
1/13/15 8:06		52.2		22.97
1/13/15 9:06		52.2		22.97
1/13/15 10:06		52.9		23.28
1/13/15 11:06		52.5		23.10
1/13/15 12:06		52.7		23.19
1/13/15 13:06		52.6		23.14
1/13/15 14:06		52.7		23.19
1/13/15 15:06		52.5		23.10
1/13/15 16:06		52.4		23.06
1/13/15 17:06		52.4		23.06
1/13/15 18:06		52.4		23.06
1/13/15 19:06		52.3		23.01
1/13/15 20:06		52.3		23.01
1/13/15 21:06		52.3		23.01
1/13/15 22:06		52.6		23.14
1/13/15 23:06		52.8		23.23
1/14/15 0:06	Jan-15	53.3	1.21	23.45
1/14/15 1:06		53		23.32
1/14/15 2:06		52.7		23.19
1/14/15 3:06		52.6		23.14
1/14/15 4:06		52.6		23.14
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1/14/15 7:06		52.5		23.10
1/14/15 8:06		52.5		23.10
1/14/15 9:06		52.5		23.10
1/14/15 10:06		52.5		23.10
1/14/15 11:06		52.5		23.10
1/14/15 12:06		52.4		23.06
1/14/15 13:06		52.4		23.06
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1/14/15 16:06		52.4		23.06
1/14/15 17:06		52.4		23.06
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1/14/15 19:06		52.3		23.01
1/14/15 20:06		52.3		23.01
1/14/15 21:06		52.3		23.01
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1/14/15 23:06		52.3		23.01
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1/15/15 10:06		52.4		23.06
1/15/15 11:06		52.4		23.06
1/15/15 12:06	Jan-15	52.4	1.03	23.06
1/15/15 13:06		52.3		23.01
1/15/15 14:06		52.3		23.01
1/15/15 15:06		52.6		23.14
1/15/15 16:06		52.6		23.14
1/15/15 17:06		52.4		23.06
1/15/15 18:06		52.4		23.06
1/15/15 19:06		52.4		23.06
1/15/15 20:06		52.3		23.01
1/15/15 21:06		52.3		23.01
1/15/15 22:06		52.3		23.01
1/15/15 23:06		52.3		23.01
1/16/15 0:06		52.3		23.01
1/16/15 1:06		52.3		23.01
1/16/15 2:06		52.2		22.97
1/16/15 3:06		52.2		22.97
1/16/15 4:06		52.2		22.97
1/16/15 5:06		52.2		22.97
1/16/15 6:06		52.2		22.97
1/16/15 7:06		52.2		22.97
1/16/15 8:06		52.2		22.97
1/16/15 9:06		52.2		22.97
1/16/15 10:06		52.2		22.97
1/16/15 11:06		52.2		22.97
1/16/15 12:06	Jan-15	52.2	1.25	22.97
1/16/15 13:06		52.2		22.97
1/16/15 14:06		52.2		22.97
1/16/15 15:06		52.2		22.97
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1/16/15 17:06		52.2		22.97
1/16/15 18:06		52.2		22.97
1/16/15 19:06		52.2		22.97
1/16/15 20:06		52.1		22.92
1/16/15 21:06		52.1		22.92
1/16/15 22:06		52.1		22.92
1/16/15 23:06		52.1		22.92
1/17/15 0:06		52.1		22.92
1/17/15 1:06		52.1		22.92

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1/17/15 3:06		52.1		22.92
1/17/15 4:06		52.1		22.92
1/17/15 5:06		52.1		22.92
1/17/15 6:06		52.2		22.97
1/17/15 7:06		52.2		22.97
1/17/15 8:06		52.2		22.97
1/17/15 9:06		52.2		22.97
1/17/15 10:06		52.2		22.97
1/17/15 11:06	Jan-15	52.2	0.31	22.97
1/17/15 12:06		52.2		22.97
1/17/15 13:06		52.2		22.97
1/17/15 14:06		52.1		22.92
1/17/15 15:06		52.2		22.97
1/17/15 16:06		52.2		22.97
1/17/15 17:06		52.2		22.97
1/17/15 18:06		52.2		22.97
1/17/15 19:06		52.2		22.97
1/17/15 20:06		52.2		22.97
1/17/15 21:06		52.2		22.97
1/17/15 22:06		52.2		22.97
1/17/15 23:06		52.2		22.97
1/18/15 0:06		52.2		22.97
1/18/15 1:06		52.2		22.97
1/18/15 2:06		52.2		22.97
1/18/15 3:06		52.2		22.97
1/18/15 4:06		52.2		22.97
1/18/15 5:06		52.2		22.97
1/18/15 6:06		52.2		22.97
1/18/15 7:06		52.2		22.97
1/18/15 8:06		52.2		22.97
1/18/15 9:06		52.2		22.97
1/18/15 10:06		52.2		22.97
1/18/15 11:06	Jan-15	52.2	0	22.97
1/18/15 12:06		52.2		22.97
1/18/15 13:06		52.2		22.97
1/18/15 14:06		52.1		22.92
1/18/15 15:06		52.1		22.92
1/18/15 16:06		52.1		22.92
1/18/15 17:06		52.1		22.92
1/18/15 18:06		52.2		22.97
1/18/15 19:06		52.2		22.97
1/18/15 20:06		52.2		22.97
1/18/15 21:06		52.2		22.97
1/18/15 22:06		52.2		22.97
1/18/15 23:06		52.2		22.97
1/19/15 0:06		52.2		22.97
1/19/15 1:06		52.2		22.97
1/19/15 2:06		52.1		22.92

1/19/15 3:06		52.1		22.92
1/19/15 4:06		52.1		22.92
1/19/15 5:06		52.1		22.92
1/19/15 6:06		52.1		22.92
1/19/15 7:06		52.1		22.92
1/19/15 8:06		52.1		22.92
1/19/15 9:06		52.1		22.92
1/19/15 10:06		52.1		22.92
1/19/15 11:06	Jan-15	52.1	0.58	22.92
1/19/15 12:06		52.1		22.92
1/19/15 13:06		52.1		22.92
1/19/15 14:06		52.1		22.92
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1/19/15 18:06		52.1		22.92
1/19/15 19:06		52.1		22.92
1/19/15 20:06		52.1		22.92
1/19/15 21:06		52.1		22.92
1/19/15 22:06		52.1		22.92
1/19/15 23:06		52.1		22.92
1/20/15 0:06		52.1		22.92
1/20/15 1:06		52.1		22.92
1/20/15 2:06		52.1		22.92
1/20/15 3:06		52.1		22.92
1/20/15 4:06		52.1		22.92
1/20/15 5:06		52.1		22.92
1/20/15 6:06		52.1		22.92
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1/20/15 9:06		52.1		22.92
1/20/15 10:06		52.1		22.92
1/20/15 11:06	Jan-15	52.1	0.04	22.92
1/20/15 12:06		52.1		22.92
1/20/15 13:06		52.1		22.92
1/20/15 14:06		52.1		22.92
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1/20/15 16:06		52.1		22.92
1/20/15 17:06		52.1		22.92
1/20/15 18:06		52.1		22.92
1/20/15 19:06		52.1		22.92
1/20/15 20:06		52.1		22.92
1/20/15 21:06		52.1		22.92
1/20/15 22:06		52.1		22.92
1/20/15 23:06		52.1		22.92
1/21/15 0:06		52.1		22.92
1/21/15 1:06		52.1		22.92
1/21/15 2:06		52.1		22.92
1/21/15 3:06		52.1		22.92

1/21/15 4:06		52.1		22.92
1/21/15 5:06		52.1		22.92
1/21/15 6:06		52.1		22.92
1/21/15 7:06		52.1		22.92
1/21/15 8:06		52.1		22.92
1/21/15 9:06	Jan-15	52.1	0.22	22.92
1/21/15 10:06		52.1		22.92
1/21/15 11:06		52.1		22.92
1/21/15 12:06		52.1		22.92
1/21/15 13:06		52.1		22.92
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1/21/15 15:06		52.1		22.92
1/21/15 16:06		52.1		22.92
1/21/15 17:06		52.1		22.92
1/21/15 18:06		52		22.88
1/21/15 19:06		52		22.88
2/7/15 13:07		54		23.76
2/7/15 14:07		54		23.76
2/7/15 15:07		53.9		23.72
2/7/15 16:07		53.9		23.72
2/7/15 17:07		53.9		23.72
2/7/15 18:07	Feb-15	53.9	0.49	23.72
2/7/15 19:07		53.9		23.72
2/7/15 20:07		53.9		23.72
2/7/15 21:07		53.9		23.72
2/7/15 22:07		53.9		23.72
2/7/15 23:07		53.9		23.72
2/8/15 0:07		53.8		23.67
2/8/15 1:07		53.8		23.67
2/8/15 2:07		53.8		23.67
2/8/15 3:07		53.8		23.67
2/8/15 4:07		53.8		23.67
2/8/15 5:07		53.8		23.67
2/8/15 6:07		53.8		23.67
2/8/15 7:07		53.8		23.67
2/8/15 8:07		53.7		23.63
2/8/15 9:07		53.7		23.63
2/8/15 10:07		53.7		23.63
2/8/15 11:07		53.7		23.63
2/8/15 12:07	Feb-15	53.6	0.89	23.58
2/8/15 13:07		53.6		23.58
2/8/15 14:07		53.6		23.58
2/8/15 15:07		53.5		23.54
2/8/15 16:07		53.5		23.54
2/8/15 17:07		53.5		23.54
2/8/15 18:07		53.6		23.58
2/8/15 19:07		53.6		23.58
2/8/15 20:07		53.6		23.58
2/8/15 21:07		53.6		23.58

2/8/15 22:07		53.5		23.54
2/8/15 23:07		53.5		23.54
2/9/15 0:07		53.5		23.54
2/9/15 1:07		53.5		23.54
2/9/15 2:07		53.5		23.54
2/9/15 3:07		53.5		23.54
2/9/15 4:07		53.5		23.54
2/9/15 5:07		53.5		23.54
2/9/15 6:07		53.5		23.54
2/9/15 7:07		53.5		23.54
2/9/15 8:07		53.5		23.54
2/9/15 9:07		53.5		23.54
2/9/15 10:07		53.4		23.50
2/9/15 11:07	Feb-15	53.4	0.63	23.50
2/9/15 12:07		53.5		23.54
2/9/15 13:07		53.4		23.50
2/9/15 14:07		53.3		23.45
2/9/15 15:07		53.3		23.45
2/9/15 16:07		53.3		23.45
2/9/15 17:07		53.3		23.45
2/9/15 18:07		53.3		23.45
2/9/15 19:07		53.3		23.45
2/9/15 20:07		53.3		23.45
2/9/15 21:07		53.3		23.45
2/9/15 22:07		53.3		23.45
2/9/15 23:07		53.3		23.45
2/10/15 0:07		53.3		23.45
2/10/15 1:07		53.3		23.45
2/10/15 2:07		53.3		23.45
2/10/15 3:07		53.3		23.45
2/10/15 4:07		53.3		23.45
2/10/15 5:07		53.3		23.45
2/10/15 6:07		53.3		23.45
2/10/15 7:07		53.3		23.45
2/10/15 8:07		53.3		23.45
2/10/15 9:07		53.3		23.45
2/10/15 10:07		53.3		23.45
2/10/15 11:07	Feb-15	53.2	0.54	23.41
2/10/15 12:07		53.2		23.41
2/10/15 13:07		60.5		26.62
2/10/15 14:07		60.5		26.62
2/10/15 15:07		54.9		24.16
2/10/15 16:07		54.7		24.07
2/10/15 17:07		54.6		24.02
2/10/15 18:07		54.5		23.98
2/10/15 19:07		54.5		23.98
2/10/15 20:07		54.4		23.94
2/10/15 21:07		54.4		23.94
2/10/15 22:07		54.4		23.94

2/10/15 23:07		54.3		23.89
2/11/15 0:07	Feb-15	54.3	1.3	23.89
2/11/15 1:07		54.3		23.89
2/11/15 2:07		54.3		23.89
2/11/15 3:07		54.2		23.85
2/11/15 4:07		54.2		23.85
2/11/15 5:07		54.2		23.85
2/11/15 6:07		54.2		23.85
2/11/15 7:07		54.1		23.80
2/11/15 8:07		54.1		23.80
2/11/15 9:07		54.1		23.80
2/11/15 10:07		54.1		23.80
2/11/15 11:07		54		23.76
2/11/15 12:07		54		23.76
2/11/15 13:07		54		23.76
2/11/15 14:07		54		23.76
2/11/15 15:07		53.9		23.72
2/11/15 16:07		53.9		23.72
2/11/15 17:07		53.9		23.72
2/11/15 18:07		53.9		23.72
2/11/15 19:07		53.8		23.67
2/11/15 20:07		53.8		23.67
2/11/15 21:07		53.8		23.67
2/11/15 22:07		53.8		23.67
2/11/15 23:07		53.8		23.67
2/12/15 0:07	Feb-15	53.8	2.01	23.67
2/12/15 1:07		53.8		23.67
2/12/15 2:07		53.7		23.63
2/12/15 3:07		53.7		23.63
2/12/15 4:07		53.7		23.63
2/12/15 5:07		53.7		23.63
2/12/15 6:07		53.7		23.63
2/12/15 7:07		53.7		23.63
2/12/15 8:07		53.7		23.63
2/12/15 9:07		53.6		23.58
2/12/15 10:07		53.6		23.58
2/12/15 11:07		53.6		23.58
2/12/15 12:07		53.6		23.58
2/12/15 13:07		53.6		23.58
2/12/15 14:07		53.5		23.54
2/12/15 15:07		53.5		23.54
2/12/15 16:07		53.5		23.54
2/12/15 17:07		53.5		23.54
2/12/15 18:07		53.5		23.54
2/12/15 19:07		53.5		23.54
2/12/15 20:07		53.5		23.54
2/12/15 21:07		53.4		23.50
2/12/15 22:07		53.4		23.50
2/12/15 23:07		53.4		23.50

2/13/15 0:07		53.4		23.50
2/13/15 1:07		53.4		23.50
2/13/15 2:07		53.4		23.50
2/13/15 3:07		53.4		23.50
2/13/15 4:07		53.4		23.50
2/13/15 5:07		53.4		23.50
2/13/15 6:07		53.4		23.50
2/13/15 7:07		53.4		23.50
2/13/15 8:07		53.3		23.45
2/13/15 9:07		53.3		23.45
2/13/15 10:07		53.3		23.45
2/13/15 11:07		53.3		23.45
2/13/15 12:07	Feb-15	53.3	0.22	23.45
2/13/15 13:07		53.3		23.45
2/13/15 14:07		53.2		23.41
2/13/15 15:07		53.2		23.41
2/13/15 16:07		53.2		23.41
2/13/15 17:07		53.2		23.41
2/13/15 18:07		53.2		23.41
2/13/15 19:07		53.2		23.41
2/13/15 20:07		53.2		23.41
2/13/15 21:07		53.2		23.41
2/13/15 22:07		53.2		23.41
2/13/15 23:07		53.2		23.41
2/14/15 0:07		53.2		23.41
2/14/15 1:07		53.2		23.41
2/14/15 2:07		53.2		23.41
2/14/15 3:07		53.2		23.41
2/14/15 4:07		53.2		23.41
2/14/15 5:07		53.2		23.41
2/14/15 6:07		53.2		23.41
2/14/15 7:07		53.2		23.41
2/14/15 8:07		53.2		23.41
2/14/15 9:07		53.2		23.41
2/14/15 10:07		53.2		23.41
2/14/15 11:07		53.2		23.41
2/14/15 12:07	Feb-15	53.1	0.04	23.36
2/14/15 13:07		53.1		23.36
2/14/15 14:07		53.1		23.36
2/14/15 15:07		53.1		23.36
2/14/15 16:07		53.1		23.36
2/14/15 17:07		53.1		23.36
2/14/15 18:07		60.5		26.62
2/14/15 19:07		60.5		26.62
2/14/15 20:07		60.5		26.62
2/14/15 21:07		54.9		24.16
2/14/15 22:07		54.8		24.11
2/14/15 23:07		54.6		24.02
2/15/15 0:07		54.6		24.02

2/15/15 1:07		54.5		23.98
2/15/15 2:07		54.5		23.98
2/15/15 3:07		54.4		23.94
2/15/15 4:07		54.4		23.94
2/15/15 5:07		54.4		23.94
2/15/15 6:07		54.3		23.89
2/15/15 7:07		54.3		23.89
2/15/15 8:07		54.3		23.89
2/15/15 9:07		54.2		23.85
2/15/15 10:07		54.2		23.85
2/15/15 11:07		54.2		23.85
2/15/15 12:07	Feb-15	54.1	0.4	23.80
2/15/15 13:07		54.1		23.80
2/15/15 14:07		54.1		23.80
2/15/15 15:07		54.1		23.80
2/15/15 16:07		54		23.76
2/15/15 17:07		54		23.76
2/15/15 18:07		54		23.76
2/15/15 19:07		54		23.76
2/15/15 20:07		54		23.76
2/15/15 21:07		54		23.76
2/15/15 22:07		54		23.76
2/15/15 23:07		54		23.76
2/16/15 0:07		53.9		23.72
2/16/15 1:07		53.9		23.72
2/16/15 2:07		53.9		23.72
2/16/15 3:07		53.9		23.72
2/16/15 4:07		53.8		23.67
2/16/15 5:07		53.8		23.67
2/16/15 6:07		53.8		23.67
2/16/15 7:07		53.8		23.67
2/16/15 8:07		53.8		23.67
2/16/15 9:07		53.8		23.67
2/16/15 10:07		53.7		23.63
2/16/15 11:07		53.7		23.63
2/16/15 12:07	Feb-15	53.7	1.92	23.63
2/16/15 13:07		53.7		23.63
2/16/15 14:07		53.6		23.58
2/16/15 15:07		53.6		23.58
2/16/15 16:07		53.6		23.58
2/16/15 17:07		53.6		23.58
2/16/15 18:07		53.5		23.54
2/16/15 19:07		53.5		23.54
2/16/15 20:07		53.5		23.54
2/16/15 21:07		53.5		23.54
2/16/15 22:07		53.5		23.54
2/16/15 23:07		53.5		23.54
2/17/15 0:07		53.5		23.54
2/17/15 1:07		53.5		23.54

2/17/15 2:07		53.5		23.54
2/17/15 3:07		53.8		23.67
2/17/15 4:07		53.6		23.58
2/17/15 5:07		53.5		23.54
2/17/15 6:07		53.4		23.50
2/17/15 7:07		53.4		23.50
2/17/15 8:07		53.4		23.50
2/17/15 9:07		53.4		23.50
2/17/15 10:07		53.4		23.50
2/17/15 11:07	Feb-15	53.4	1.07	23.50
2/17/15 12:07		58.8		25.87
2/17/15 13:07		60.3		26.53
2/17/15 14:07		54.8		24.11
2/17/15 15:07		54.5		23.98
2/17/15 16:07		54.4		23.94
2/17/15 17:07		54.3		23.89
2/17/15 18:07		54.2		23.85
2/17/15 19:07		54.2		23.85
2/17/15 20:07		54.2		23.85
2/17/15 21:07		54.2		23.85
2/17/15 22:07		54.1		23.80
2/17/15 23:07		54.1		23.80
2/18/15 0:07		54.1		23.80
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2/18/15 2:07		54.1		23.80
2/18/15 3:07		54		23.76
2/18/15 4:07		54		23.76
2/18/15 5:07		54		23.76
2/18/15 6:07		54		23.76
2/18/15 7:07		53.9		23.72
2/18/15 8:07		53.9		23.72
2/18/15 9:07		53.9		23.72
2/18/15 10:07		53.9		23.72
2/18/15 11:07	Feb-15	53.8	0.67	23.67
2/18/15 12:07		53.8		23.67
2/18/15 13:07		53.7		23.63
2/18/15 14:07		53.7		23.63
2/18/15 15:07		53.6		23.58
2/18/15 16:07		53.6		23.58
2/18/15 17:07		53.6		23.58
2/18/15 18:07		53.6		23.58
2/18/15 19:07		53.6		23.58
2/18/15 20:07		53.6		23.58
2/18/15 21:07		53.5		23.54
2/18/15 22:07		53.5		23.54
2/18/15 23:07		53.5		23.54
2/19/15 0:07		53.5		23.54
2/19/15 1:07		53.5		23.54
2/19/15 2:07		53.5		23.54

2/19/15 3:07		53.5		23.54
2/19/15 4:07		53.5		23.54
2/19/15 5:07		53.5		23.54
2/19/15 6:07		53.4		23.50
2/19/15 7:07		53.4		23.50
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2/19/15 10:07		53.4		23.50
2/19/15 11:07	Feb-15	53.4	0.31	23.50
2/19/15 12:07		53.3		23.45
2/19/15 13:07		53.3		23.45
2/19/15 14:07		53.3		23.45
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2/19/15 18:07		53.3		23.45
2/19/15 19:07		53.3		23.45
2/19/15 20:07		53.3		23.45
2/19/15 21:07		53.3		23.45
2/19/15 22:07		53.2		23.41
2/19/15 23:07		53.3		23.45
2/20/15 0:07		53.3		23.45
2/20/15 1:07		53.3		23.45
2/20/15 2:07		53.3		23.45
2/20/15 3:07		53.3		23.45
2/20/15 4:07		53.3		23.45
2/20/15 5:07		53.3		23.45
2/20/15 6:07		53.2		23.41
2/20/15 7:07		53.2		23.41
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2/20/15 9:07		53.2		23.41
2/20/15 10:07		53.2		23.41
2/20/15 11:07	Feb-15	53.2	0.27	23.41
2/20/15 12:07		53.2		23.41
2/20/15 13:07		53.2		23.41
2/20/15 14:07		53.2		23.41
2/20/15 15:07		53.2		23.41
2/20/15 16:07		53.1		23.36
2/20/15 17:07		53.1		23.36
2/20/15 18:07		53.1		23.36
2/20/15 19:07		53.1		23.36
2/20/15 20:07		53.1		23.36
2/20/15 21:07		53.1		23.36
2/20/15 22:07		53.1		23.36
2/20/15 23:07		53.1		23.36
2/21/15 0:07		53.1		23.36
2/21/15 1:07		53.1		23.36
2/21/15 2:07		53.1		23.36
2/21/15 3:07		53.1		23.36

2/21/15 4:07		53.1		23.36
2/21/15 5:07		53.1		23.36
2/21/15 6:07		53.1		23.36
2/21/15 7:07		53.1		23.36
2/21/15 8:07		53.1		23.36
2/21/15 9:07		53.1		23.36
2/21/15 10:07		53.1		23.36
2/21/15 11:07	Feb-15	53	0.85	23.32
2/21/15 12:07		53		23.32
2/21/15 13:07		53		23.32
2/21/15 14:07		53		23.32
2/21/15 15:07		53		23.32
2/21/15 16:07		53		23.32
2/21/15 17:07		53		23.32
2/21/15 18:07		53		23.32
2/21/15 19:07		53		23.32
2/21/15 20:07		53		23.32
2/21/15 21:07		53		23.32
2/21/15 22:07		60.3		26.53
2/21/15 23:07		60.3		26.53
2/22/15 0:07		60.3		26.53
2/22/15 1:07		54.9		24.16
2/22/15 2:07		54.6		24.02
2/22/15 3:07		54.5		23.98
2/22/15 4:07		54.5		23.98
2/22/15 5:07		54.4		23.94
2/22/15 6:07		54.4		23.94
2/22/15 7:07		54.3		23.89
2/22/15 8:07		54.3		23.89
2/22/15 9:07		54.2		23.85
2/22/15 10:07		54.2		23.85
2/22/15 11:07	Feb-15	54.2	0.27	23.85
2/22/15 12:07		54.2		23.85
2/22/15 13:07		54.1		23.80
2/22/15 14:07		54.1		23.80
2/22/15 15:07		54.1		23.80
2/22/15 16:07		54.1		23.80
2/22/15 17:07		54		23.76
2/22/15 18:07		54		23.76
2/22/15 19:07		54		23.76
2/22/15 20:07		54		23.76
2/22/15 21:07		54		23.76
2/22/15 22:07		54		23.76
2/22/15 23:07		54		23.76
2/23/15 0:07		53.9		23.72
2/23/15 1:07		53.9		23.72
2/23/15 2:07		53.9		23.72
2/23/15 3:07		53.9		23.72
2/23/15 4:07		53.9		23.72

2/23/15 5:07		53.8		23.67
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2/23/15 7:07		53.8		23.67
2/23/15 8:07		53.8		23.67
2/23/15 9:07		53.8		23.67
2/23/15 10:07		53.8		23.67
2/23/15 11:07	Feb-15	53.8	1.12	23.67
2/23/15 12:07		53.7		23.63
2/23/15 13:07		53.7		23.63
2/23/15 14:07		53.7		23.63
2/23/15 15:07		53.7		23.63
2/23/15 16:07		53.7		23.63
2/23/15 17:07		53.6		23.58
2/23/15 18:07		53.6		23.58
2/23/15 19:07		53.6		23.58
2/23/15 20:07		53.6		23.58
2/23/15 21:07		53.6		23.58
2/23/15 22:07		53.6		23.58
2/23/15 23:07		53.6		23.58
2/24/15 0:07		53.5		23.54
2/24/15 1:07		53.5		23.54
2/24/15 2:07		53.9		23.72
2/24/15 3:07		53.6		23.58
2/24/15 4:07		53.6		23.58
2/24/15 5:07		53.5		23.54
2/24/15 6:07		53.5		23.54
2/24/15 7:07		53.5		23.54
2/24/15 8:07		53.5		23.54
2/24/15 9:07		53.4		23.50
2/24/15 10:07		53.4		23.50
2/24/15 11:07	Feb-15	53.4	1.12	23.50
2/24/15 12:07		53.4		23.50
2/24/15 13:07		53.4		23.50
2/24/15 14:07		53.3		23.45
2/24/15 15:07		53.3		23.45
2/24/15 16:07		53.3		23.45
2/24/15 17:07		53.3		23.45
2/24/15 18:07		53.3		23.45
2/24/15 19:07		53.3		23.45
2/24/15 20:07		53.2		23.41
2/24/15 21:07		53.2		23.41
2/24/15 22:07		53.2		23.41
2/24/15 23:07		53.3		23.45
2/25/15 0:07		53.5		23.54
2/25/15 1:07		53.9		23.72
2/25/15 2:07		54.2		23.85
2/25/15 3:07		54.1		23.80
2/25/15 4:07		53.7		23.63
2/25/15 5:07		53.6		23.58

2/25/15 6:07	Feb-15	53.5	0.85	23.54
2/25/15 7:07		53.5		23.54
2/25/15 8:07		53.4		23.50
2/25/15 9:07		53.4		23.50
2/25/15 10:07		53.3		23.45
2/25/15 11:07		53.3		23.45
2/25/15 12:07		53.2		23.41
2/25/15 13:07		53.2		23.41
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2/25/15 15:07		53.2		23.41
2/25/15 16:07		53.2		23.41
2/25/15 17:07		53.2		23.41
2/25/15 18:07		53.2		23.41
2/25/15 19:07		53.2		23.41
2/25/15 20:07		53.2		23.41
2/25/15 21:07		53.2		23.41
2/25/15 22:07		53.2		23.41
2/25/15 23:07		53.2		23.41
2/26/15 0:07	Feb-15	53.3	0.27	23.45
2/26/15 1:07		53.3		23.45
2/26/15 2:07		53.3		23.45
2/26/15 3:07		53.3		23.45
2/26/15 4:07		53.2		23.41
2/26/15 5:07		53.2		23.41
2/26/15 6:07		53.2		23.41
2/26/15 7:07		53.2		23.41
2/26/15 8:07		53.2		23.41
2/26/15 9:07		53.2		23.41
2/26/15 10:07		53.2		23.41
2/26/15 11:07		53.2		23.41
2/26/15 12:07		53.2		23.41
2/26/15 13:07		53.2		23.41
2/26/15 14:07		53.1		23.36
2/26/15 15:07		53.1		23.36
2/26/15 16:07		53.1		23.36
2/26/15 17:07		53.1		23.36
2/26/15 18:07		53.1		23.36
2/26/15 19:07		53.1		23.36
2/26/15 20:07		53.1		23.36
2/26/15 21:07		53.1		23.36
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2/26/15 23:07		53.1		23.36
2/27/15 0:07		53.1		23.36
2/27/15 1:07		53.1		23.36
2/27/15 2:07		53.1		23.36
2/27/15 3:07		53.1		23.36
2/27/15 4:07		53.1		23.36
2/27/15 5:07		53		23.32
2/27/15 6:07		53		23.32

2/27/15 7:07		53		23.32
2/27/15 8:07		60.4		26.58
2/27/15 9:07		60.4		26.58
2/27/15 10:07		60.4		26.58
2/27/15 11:07	Feb-15	54.8	0.76	24.11
2/27/15 12:07		54.6		24.02
2/27/15 13:07		54.5		23.98
2/27/15 14:07		54.5		23.98
2/27/15 15:07		54.4		23.94
2/27/15 16:07		54.3		23.89
2/27/15 17:07		54.3		23.89
2/27/15 18:07		54.3		23.89
2/27/15 19:07		54.3		23.89
2/27/15 20:07		54.2		23.85
2/27/15 21:07		54.2		23.85
2/27/15 22:07		54.2		23.85
2/27/15 23:07		54.2		23.85
2/28/15 0:07		54.2		23.85
2/28/15 1:07		54.1		23.80
2/28/15 2:07		54.1		23.80
2/28/15 3:07		54.1		23.80
2/28/15 4:07		54.1		23.80
2/28/15 5:07		54.1		23.80
2/28/15 6:07		54.1		23.80
2/28/15 7:07		54		23.76
2/28/15 8:07		54		23.76
2/28/15 9:07		54		23.76
2/28/15 10:07		54		23.76
2/28/15 11:07	Feb-15	54	2.73	23.76
2/28/15 12:07		53.9		23.72
2/28/15 13:07		53.9		23.72
2/28/15 14:07		53.9		23.72
2/28/15 15:07		53.9		23.72
2/28/15 16:07		53.8		23.67
2/28/15 17:07		53.8		23.67
2/28/15 18:07		53.8		23.67
2/28/15 19:07		53.9		23.72
2/28/15 20:07		54		23.76
2/28/15 21:07		53.9		23.72
2/28/15 22:07		53.9		23.72
2/28/15 23:07		53.8		23.67
3/1/15 0:07		53.8		23.67
3/1/15 1:07		53.8		23.67
3/1/15 2:07		53.8		23.67
3/1/15 3:07		53.8		23.67
3/1/15 4:07		53.8		23.67
3/1/15 5:07	Mar-15	53.7	2.55	23.63
3/1/15 6:07		53.7		23.63
3/1/15 7:07		53.7		23.63

3/1/15 8:07	53.7	23.63
3/1/15 9:07	53.7	23.63
3/1/15 10:07	53.7	23.63
3/1/15 11:07	53.6	23.58

Power (kWh)
0.17
0.00
0.00
0.00
1.97
2.14

	Power Proc
5.28	-15.84
0.48	-20.636
-1.01	-22.132
1.10	-20.02
0.09	-21.032
0.00	-21.12

-0.13	-21.252
-0.79	-21.912
-0.31	-21.428
0.79	-20.328
0.22	-20.9
-0.44	-21.56
0.26	-20.856
0.09	-21.032
0.13	-20.988
0.04	-21.076
0.13	-20.988
0.00	-21.12
0.04	-21.076
0.00	-21.12
0.00	-21.12
0.00	-21.12
0.00	-21.12
0.04	-21.076
0.00	-21.12
0.00	-21.12
0.00	-21.12
0.00	-21.12
0.00	-21.12
0.00	-21.12
0.04	-21.076
-0.04	-21.164
0.04	-21.076
-0.13	-21.252
0.04	-21.076
0.00	-21.12
0.04	-21.076
0.04	-21.076
0.00	-21.12
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0.00	-21.12
0.00	-21.12
0.04	-21.076
-0.04	-21.164
0.00	-21.12
0.04	-21.076
0.00	-21.12

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0.04	-21.076
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0.04	-21.076
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0.00	-21.12
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0.00	-21.12
0.00	-21.12
0.04	-21.076
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0.04	-21.076

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0.00	-21.12
0.00	-21.12
0.04	-21.076
0.00	-21.12
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0.00	-21.12
0.00	-21.12
0.04	-21.076
0.00	-21.12
0.00	-21.12
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0.00	-21.12
0.00	-21.12

0.00	-21.12
0.00	-21.12
0.04	-21.076
23.58	2.464

	Small Scale
Item	**Est. Cost**
Large blades (set of 3)	$250.00
Large magnets N50 Neodymium 3 x 1.5 x .75 (32 for 3kw)	$24.85
Wind turbine tower system $16,000 ea	$16,000.00
Monitoring Equipment	$500.00
Misc. Equipment for infrastructure (i.e. bolts, washers, connectors)	$750.00
O&M	$200.00
Total Cost	
Total Production (kWh)	
Grant Money	
Cost/kWh	
Rate	

Average Per Day
1.5840

0.0532

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0.0018

0.0018

-0.0018

0.0018
0.0037

0.0128

0.0018

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0.0018

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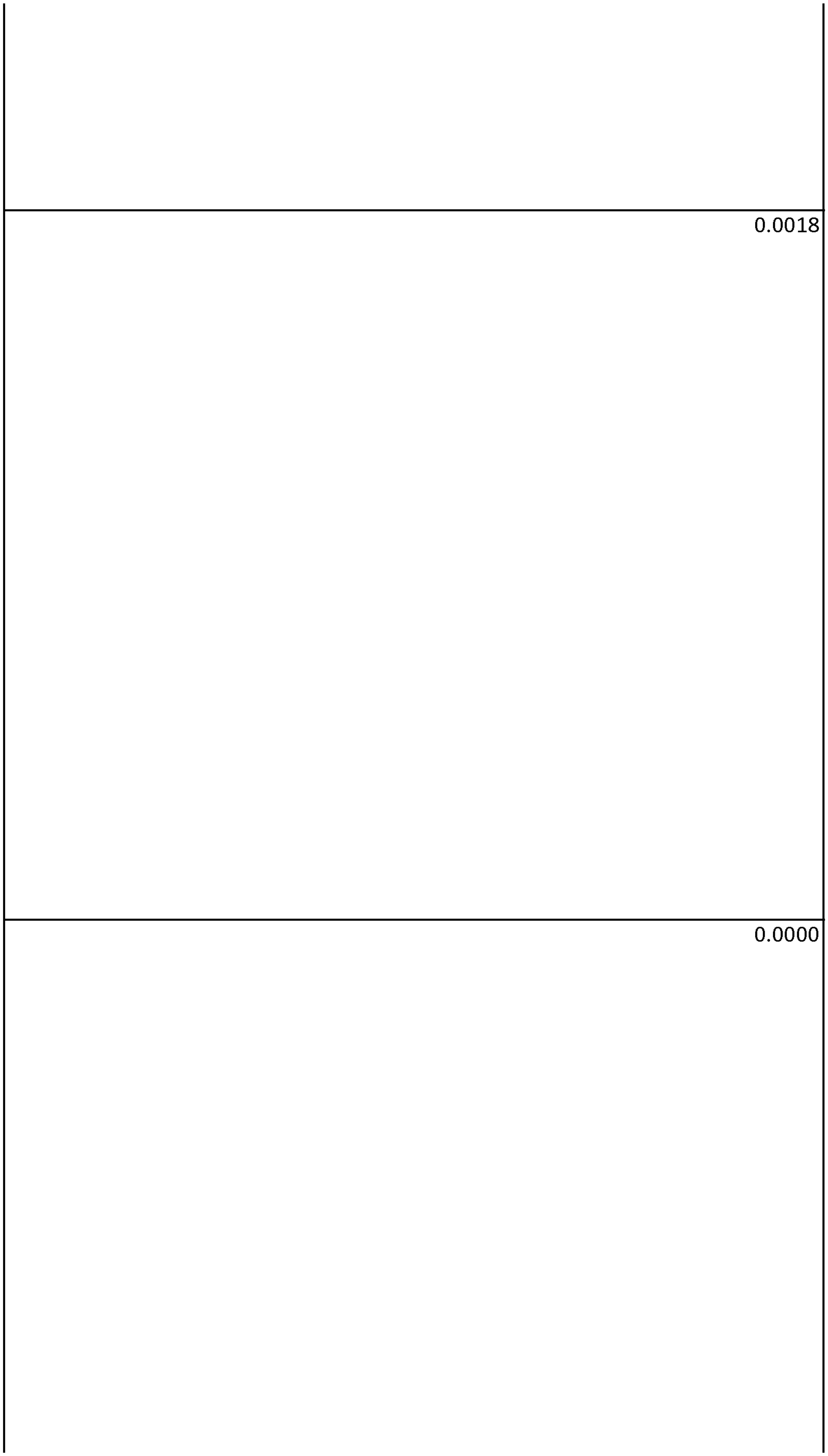
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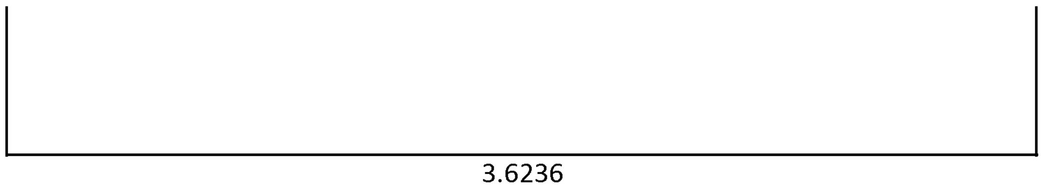
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Quantity	Total Cost	Amortized	
2	$500.00		
32	$795.20		
1	$16,000.00		
1	$500.00		
1	$750.00		
1	$200.00		
	$18,545.20		$1,963.30
	3.61		
	$ 18,545.20		$1,963.30
	$ 55.33		
	1.05%		

#DIV/0!

Medium S	Wind Speed (m/s)			
Month	Observed	Avg	High avg	Low Avg
Mar-14	6.5	5	5.8	4.25
Mar-14	3.5			
Mar-14	9	5.5	7.3	3.75
Mar-14	2			
Apr-14	2	1.5	1.8	1.25
Apr-14	1			
Apr-14	8	4.5	6.3	2.75
Apr-14	1			
Apr-14	4	6.75	5.4	8.125
Apr-14	9.5			
Apr-14	2	7	4.5	9.5
Apr-14	12			
Apr-14	1	4.25	2.6	5.875
May-14	7.5			
May-14	8	10	9.0	11
May-14	12			
May-14	3.5	3.75	3.6	3.875
May-14	4			
May-14	2.5	3.75	3.1	4.375
May-14	5			
May-14	3.5	5	4.3	5.75
Jun-14	6.5			
Jun-14	3	3.75	3.4	4.125
Jun-14	4.5			
Jun-14	3	4	3.5	4.5
Jun-14	5			
Jun-14	4	5	4.5	5.5
Jun-14	6			
Jun-14	5	5	5.0	5
Jun-14	5			
Jul-14	6.5	4.5	5.5	3.5
Jul-14	2.5			
Jul-14	3	6.25	4.6	7.875
Jul-14	9.5			
Jul-14	3	5.5	4.3	6.75
Jul-14	8			
Jul-14	2.5	4.25	3.4	5.125
Jul-14	6			
Jul-14	4	4.25	4.1	4.375
Jul-14	4.5			
Jul-14	3	2.5	2.8	2.25
Aug-14	2			
Aug-14	4	6	5.0	7
Aug-14	8			
Aug-14	8.5	6.75	7.6	5.875
Aug-14	5			
Aug-14	4	4.5	4.3	4.75

Aug-14	5			
Aug-14	5	4	4.5	3.5
Aug-14	3			
Aug-14	2	3.5	2.8	4.25
Aug-14	5			
Aug-14	4	4.75	4.4	5.125
Aug-14	5.5			
Aug-14	0	2	1.0	3
Sep-14	4			
Sep-14	2	3	2.5	3.5
Sep-14	4			
Sep-14	5	5	5.0	5
Sep-14	5			
Sep-14	8.5	5.75	7.1	4.375
Sep-14	3			
Sep-14	12	7	9.5	4.5
Sep-14	2			
Sep-14	5	5	5.0	5
Sep-14	5			
Sep-14	3.5	5.5	4.5	6.5
Sep-14	7.5			
Sep-14	6	6.5	6.3	6.75
Sep-14	7			
Oct-14	9	8.75	8.9	8.625
Oct-14	8.5			
Oct-14	3	6	4.5	7.5
Oct-14	9			
Oct-14	1	0.5	0.8	0.25
Oct-14	0			
Oct-14	3	1.5	2.3	0.75
Oct-14	0			
Oct-14	2.5	1.25	1.9	0.625
Oct-14	0			
Oct-14	10	6	8.0	4
Oct-14	2			
Oct-14	1.5	5	3.3	6.75
Nov-14	8.5			
Nov-14	5.5	8.75	7.1	10.375
Nov-14	12			
Nov-14	0	5.75	2.9	8.625
Nov-14	11.5			
Nov-14	9.5	12.25	10.9	13.625
Nov-14	15			
Nov-14	8	9	8.5	9.5
Nov-14	10			
Nov-14	2.5	5.25	3.9	6.625
Nov-14	8			
Nov-14	3	4.5	3.8	5.25

Nov-14	6			
Dec-14	4	7.5	5.8	9.25
Dec-14	11			
Dec-14	11.5	6.75	9.1	4.375
Dec-14	2			
Dec-14	11	6	8.5	3.5
Dec-14	1			
Dec-14	13	12.25	12.6	11.875
Dec-14	11.5			
Dec-14	2	6	4.0	8
Dec-14	10			
Dec-14	7	9.75	8.4	11.125
Dec-14	12.5			
Dec-14	12	6.5	9.3	3.75
Dec-14	1			
Jan-15	10	9	9.5	8.5
Jan-15	8			
Jan-15	16.5	11	13.8	8.25
Jan-15	5.5			
Jan-15	13	6.5	9.8	3.25
Jan-15	0			
Jan-15	4	3.5	3.8	3.25
Jan-15	3			
Jan-15	4	5.75	4.9	6.625
Jan-15	7.5			
Jan-15	2	5.5	3.8	7.25
Feb-15	9			
Feb-15	3	3.25	3.1	3.375
Feb-15	3.5			
Feb-15	8.5	9.25	8.9	9.625
Feb-15	10			
Feb-15	10	6.5	8.3	4.75
Feb-15	3			
Feb-15	9	6.5	7.8	5.25
Feb-15	4			
Feb-15	8	4.5	6.3	2.75
Feb-15	1			
Feb-15	1	4	2.5	5.5
Feb-15	7			
Mar-15	3	4.5	3.8	5.25
Mar-15	6			
Mar-15	4	6.5	5.3	7.75
Mar-15	9			
Mar-15	2	1	1.5	0.5
Mar-15	0			
Mar-15	3	6	4.5	7.5
Mar-15	9			
Mar-15	5.5	5.5	5.5	5.5

Total

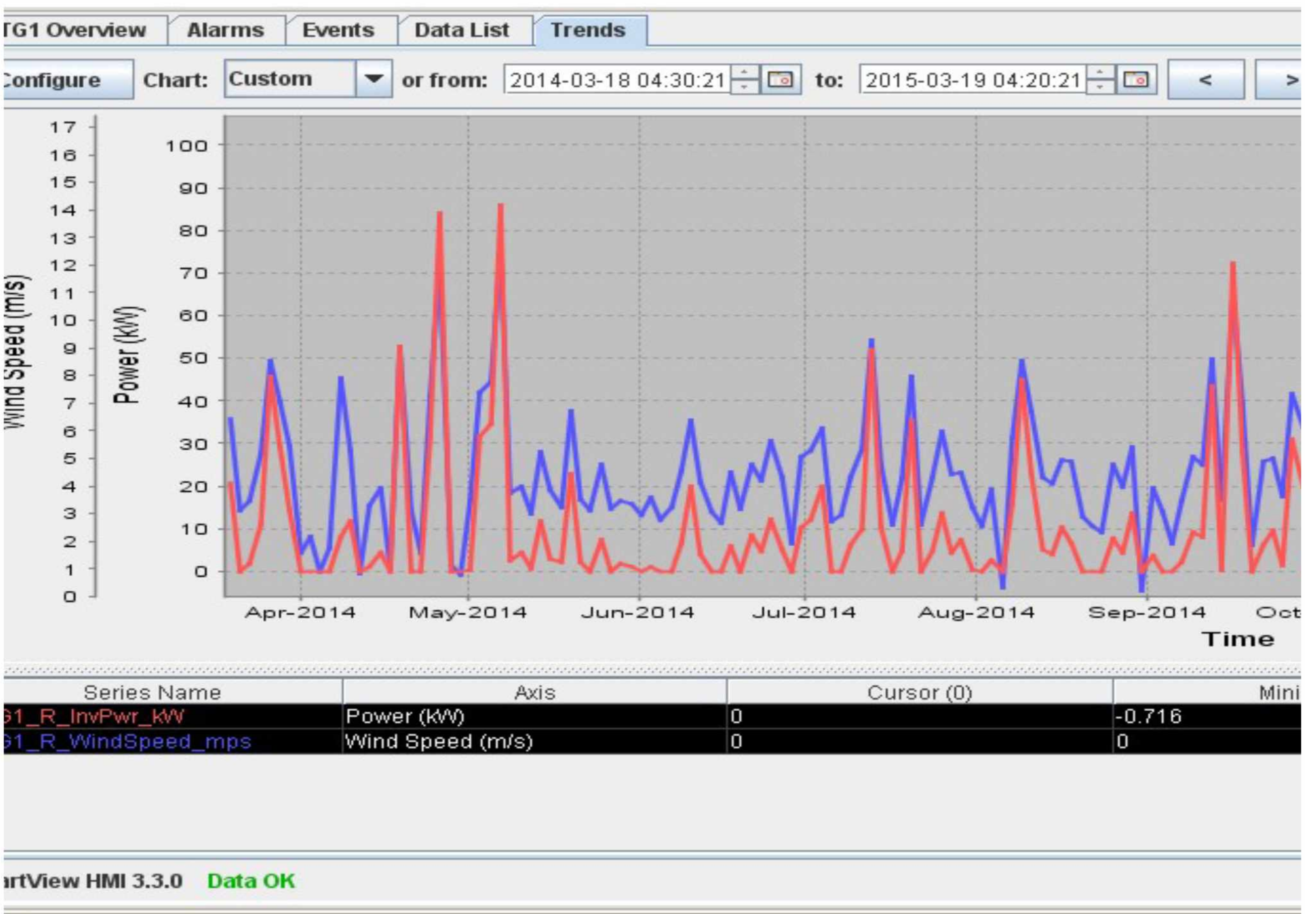
Power (kWh)					
Observed	Avg	High Avg	Low Avg	m/s Avg	kWh Avg
22	12.5	17.25	7.75		
3					
50	26.5	38.25	14.75		
3				5.25	19.50
1	1.5	1.25	1.75		
2					
12	7.5	9.75	5.25		
3					
5	29	17.00	41.00		
53					
0	42.5	21.25	63.75		
85					
0	16.5	8.25	24.75	4.69	18.83
33					
37	62	49.50	74.50		
87					
3	4	3.50	4.50		
5					
0	5.5	2.75	8.25		
11					
1.5	12.25	6.88	17.63	5.68	21.44
23					
1	3.5	2.25	4.75		
6					
0	5	2.50	7.50		
10					
6	9	7.50	10.50		
12					
0	5.5	2.75	8.25		
11				4.54	6.57
20	10	15.00	5.00		
0					
0	26	13.00	39.00		
52					
0	19	9.50	28.50		
38					
0	6	3.00	9.00		
12					
4	6	5.00	7.00		
8					
0	0	0.00	0.00	4.63	11.55
0					
3	5	4.00	6.00		
7					
47	26	36.50	15.50		
5					
4	7	5.50	8.50		

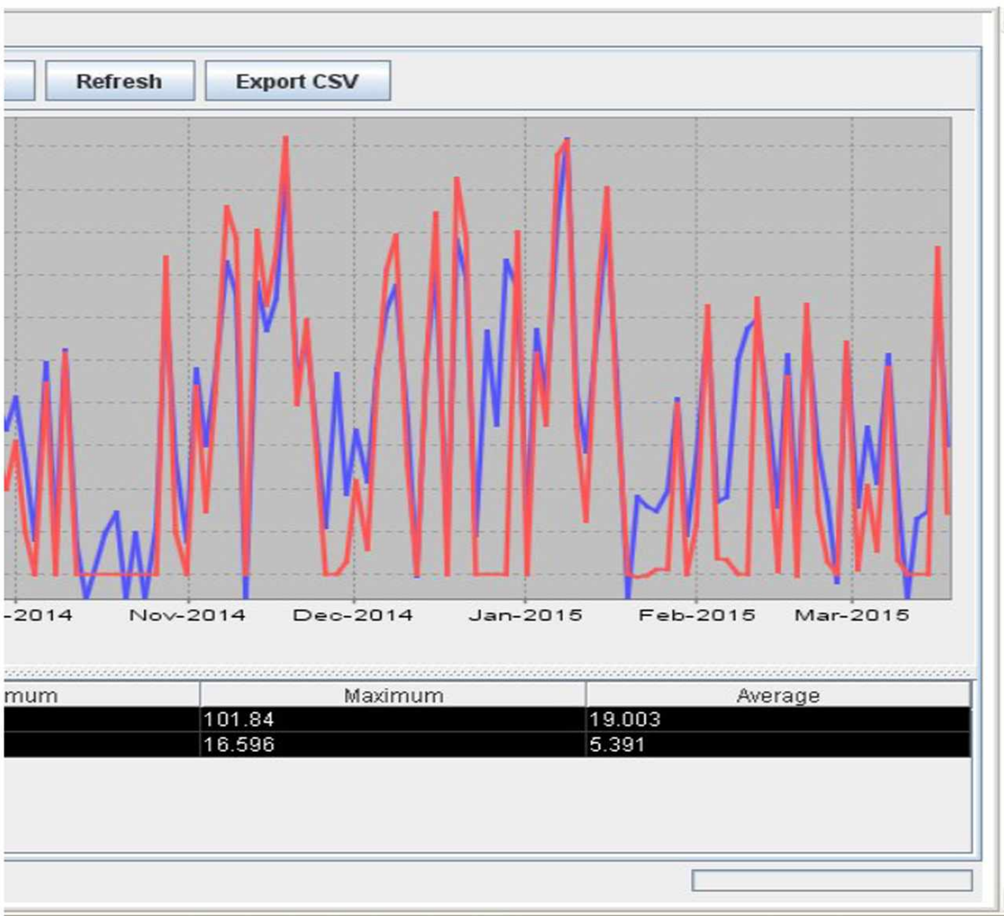
10					
8	4	6.00	2.00		
0					
0	4.5	2.25	6.75		
9					
5	9.75	7.38	12.13		
14.5					
0	1	0.50	1.50	4.44	8.12
2					
0	1	0.50	1.50		
2					
9	8.5	8.75	8.25		
8					
43	21.5	32.25	10.75		
0					
67	33.5	50.25	16.75		
0					
10	9.5	9.75	9.25		
9					
1	16	8.50	23.50		
31					
20	26	23.00	29.00		
32				5.35	16.17
0	22.5	11.25	33.75		
45					
0	26	13.00	39.00		
52					
0	0	0.00	0.00		
0					
0	0	0.00	0.00		
0					
0	0	0.00	0.00		
0					
72	39.5	55.75	23.25		
7					
0	22.5	11.25	33.75	4.01	14.93
45					
15	51	33.00	69.00		
87					
0	40.5	20.25	60.75		
81					
63	83	73.00	93.00		
103					
40	50	45.00	55.00		
60					
0	0	0.00	0.00		
0					
2	12	7.00	17.00		

22				7.61	39.60
6	39	22.50	55.50		
72					
80	40	60.00	20.00		
0					
86	43	64.50	21.50		
0					
92	86	89.00	83.00		
80					
0	0	0.00	0.00		
0					
0	0	0.00	0.00		
0					
80	40	60.00	20.00		
0				7.82	35.43
51	43.5	47.25	39.75		
36					
101	56.5	78.75	34.25		
12					
91	45.5	68.25	22.75		
0					
0	0	0.00	0.00		
0					
0	20	10.00	30.00		
40					
0	31	15.50	46.50	6.80	31.74
62					
4	4	4.00	4.00		
4					
0	0	0.00	0.00		
0					
65	32.5	48.75	16.25		
0					
47	23.5	35.25	11.75		
0					
62	31.5	46.75	16.25		
1					
0	27.5	13.75	41.25		
55				5.77	21.19
1	11	6.00	16.00		
21					
5	27	16.00	38.00		
49					
2	1	1.50	0.50		
0					
0	39	19.50	58.50		
78					
12	12	12.00	12.00	4.67	18.25

2955	**1483.5**	**1420**	**1547**		**263.32**
			7405.50		

Medium Scale			Amortized
Capital Costs	$	128,814.00	$13,636.95
O&M	$	5,429.00	
Grant	$	19,000.00	$1,900.00
Total Power Production		**7405.50**	
Cost/kWh; Captital Costs	$	1.84	
Cost/kWh; Capital Costs + O&M	$	2.57	
Cost/kWh; Capital Costs + O&M w/o grant	$	2.32	
Rate		1.05%	

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Nov-2014
Dec-2014
Jan-2015
Feb-2015
Mar-2015
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Maximum
Average
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5.391

Month	Wind Speed (m/s)	Total Production (kWh)	Production/ Turbine (kWh)	12
Mar-14	7.67	6945971	578830.92	
Apr-14	6.32	5027759	418979.92	
May-14	6.80	5903627	491968.92	
Jun-14	6.34	5043681	420306.75	
Jul-14	5.94	4627698	385641.50	
Aug-14	7.27	7141041	595086.75	
Sep-14	7.73	6346321	528860.08	
Oct-14	5.87	3122034	260169.50	
Nov-14	9.60	8849332	737444.33	
Dec-14	8.57	6685432	557119.33	
Jan-15	6.35	5769652	480804.33	
Feb-15	8.57	7745419	645451.58	
Mar-15	7.72	7317747	609812.25	
		36367582	6710476.17	

		Total	Amortized
Capital Costs	$	94,000,000.00	$9,951,353.75
Legislative Appropriation	$	10,000,000.00	$1,000,000.00
REF	$	3,600,000.00	$360,000.00
CREBS (1.05%)	$	80,400,000.00	$8,511,583.42
Yearly O&M	$	1,200,000.00	1.05%
Road Maintenance Cost	$	2,500.00	
Total Power Production		**36367582.00**	
Cost/kWh; Captital Costs	$	2.58	
Cost/kWh; Non Grant Capital Costs	$	2.21	
Cost/kWh; Capital Costs + O&M	$	2.62	
Cost/kWh; No Grant Capital Costs + O&M	$	2.24	

Per Turbine
$829,279.48
$ 83,333.33
$ 30,000.00
$ 709,298.62
$ 100,000.00
$ 25,000.00
6710476.17
$ 0.12
$ 0.11
$ 0.14
$ 0.12

2007			m/s
Dec	MPH		0.44704
5	34.00		15.20
6	40.00		17.88
7	20.00		8.94
8	24.00		10.73
9	18.00		8.05
10	30.00		13.41
11	6.00		2.68
12	3.00		1.34
13	4.00		1.79
14	3.00		1.34
15	5.00		2.24
16	6.00		2.68
17	5.00		2.24
18	8.00		3.58
19	6.00		2.68
20	9.00		4.02
21	14.00		6.26
22	22.00		9.83
23	14.00		6.26
24	6.00		2.68
25	9.00		4.02
26	5.00		2.24
27	13.00		5.81
28	9.00		4.02
29	5.00		2.24
30	4.00		1.79
31	6.00		2.68
2008	12.15		5.25
Jan	Avg		
1	5.00		2.24
2	4.00		1.79
3	1.00		0.45
4	0.00		0.00
5	0.00		0.00
6	0.00		0.00
7	0.00		0.00
8	0.00		0.00
9	0.00		0.00
10	0.00		0.00
11	0.00		0.00
12	0.00		0.00
13	0.00		0.00
14	10.00		4.47
15	33.00		14.75
16	15.00		6.71
17	27.00		12.07

18	18.00	8.05
19	11.00	4.92
20	34.00	15.20
21	6.00	2.68
22	26.00	11.62
23	11.00	4.92
24	18.00	8.05
25	9.00	4.02
26	10.00	4.47
27	29.00	12.96
28	16.00	7.15
29	5.00	2.24
30	7.00	3.13
31	4.00	1.79
2008		4.31
Feb	Avg	
1	10.00	4.47
2	9.00	4.02
3	0.00	0.00
4	6.00	2.68
5	7.00	3.13
6	9.00	4.02
7	8.00	3.58
8	12.00	5.36
9	5.00	2.24
10	8.00	3.58
11	3.00	1.34
12	6.00	2.68
13	29.00	12.96
14	36.00	16.09
15	8.00	3.58
16	29.00	12.96
17	26.00	11.62
18	25.00	11.18
19	18.00	8.05
26	6.00	2.68
27	8.00	3.58
28	5.00	2.24
29	9.00	4.02
2008		5.48
Mar	Avg	
1	6.00	2.68
2	3.00	1.34
3	26.00	11.62
4	35.00	15.65
5	34.00	15.20
6	22.00	9.83
7	23.00	10.28

8	23.00	10.28
9	13.00	5.81
10	24.00	10.73
11	7.00	3.13
12	3.00	1.34
13	4.00	1.79
14	4.00	1.79
15	27.00	12.07
16	10.00	4.47
17	6.00	2.68
18	7.00	3.13
19	6.00	2.68
20	4.00	1.79
21	6.00	2.68
22	6.00	2.68
23	6.00	2.68
24	4.00	1.79
25	4.00	1.79
26	6.00	2.68
27	6.00	2.68
28	6.00	2.68
29	24.00	10.73
30	35.00	15.65
31	31.00	13.86
2008		6.07
Apr	Avg	
1	33.00	14.75
2	21.00	9.39
3	31.00	13.86
4	34.00	15.20
5	15.00	6.71
6	7.00	3.13
7	4.00	1.79
8	11.00	4.92
9	6.00	2.68
10	6.00	2.68
11	0.00	0.00
12	7.00	3.13
13	25.00	11.18
14	18.00	8.05
15	7.00	3.13
16	11.00	4.92
17	12.00	5.36
18	24.00	10.73
19	25.00	11.18
20	24.00	10.73
21	18.00	8.05
22	10.00	4.47

23	6.00	2.68
24	9.00	4.02
25	7.00	3.13
26	5.00	2.24
27	5.00	2.24
28	5.00	2.24
29	5.00	2.24
30	4.00	1.79
2008		5.89
May	Avg	
1	4.00	1.79
2	7.00	3.13
3	12.00	5.36
4	12.00	5.36
5	12.00	5.36
6	10.00	4.47
7	22.00	9.83
8	24.00	10.73
9	17.00	7.60
10	9.00	4.02
11	21.00	9.39
12	30.00	13.41
13	26.00	11.62
14	14.00	6.26
15	26.00	11.62
16	24.00	10.73
17	4.00	1.79
18	10.00	4.47
19	6.00	2.68
20	6.00	2.68
21	5.00	2.24
22	8.00	3.58
23	30.00	13.41
24	21.00	9.39
25	20.00	8.94
26	7.00	3.13
27	0.00	0.00
28	6.00	2.68
29	5.00	2.24
30	8.00	3.58
31	21.00	9.39
2008		6.16
Jun	Avg	
1	27.00	12.07
2	18.00	8.05
3	15.00	6.71
4	17.00	7.60
5	19.00	8.49

6	9.00	4.02
7	6.00	2.68
8	8.00	3.58
9	6.00	2.68
10	5.00	2.24
11	11.00	4.92
12	5.00	2.24
13	5.00	2.24
14	6.00	2.68
15	10.00	4.47
16	3.00	1.34
17	5.00	2.24
18	9.00	4.02
19	5.00	2.24
20	7.00	3.13
21	5.00	2.24
22	12.00	5.36
23	14.00	6.26
24	19.00	8.49
25	16.00	7.15
26	12.00	5.36
27	20.00	8.94
28	17.00	7.60
29	20.00	8.94
30	11.00	4.92
2008		5.10
Jul	Avg	
1	6.00	2.68
2	13.00	5.81
3	11.00	4.92
4	6.00	2.68
5	7.00	3.13
6	9.00	4.02
7	18.00	8.05
8	18.00	8.05
9	15.00	6.71
10	18.00	8.05
11	8.00	3.58
12	14.00	6.26
13	14.00	6.26
14	8.00	3.58
15	19.00	8.49
16	32.00	14.31
17	20.00	8.94
18	4.00	1.79
19	4.00	1.79
20	4.00	1.79
21	13.00	5.81

22	4.00	1.79
23	12.00	5.36
24	11.00	4.92
25	6.00	2.68
26	5.00	2.24
27	2.00	0.89
28	16.00	7.15
29	12.00	5.36
30	8.00	3.58
31	5.00	2.24
2008		4.93
Aug	Avg	
1	11.00	4.92
2	19.00	8.49
3	6.00	2.68
4	7.00	3.13
5	4.00	1.79
6	2.00	0.89
7	4.00	1.79
8	4.00	1.79
9	4.00	1.79
10	5.00	2.24
11	9.00	4.02
12	224.00	100.14
13	10.00	4.47
14	15.00	6.71
15	15.00	6.71
16	9.00	4.02
17	5.00	2.24
18	4.00	1.79
19	6.00	2.68
20	5.00	2.24
21	3.00	1.34
22	5.00	2.24
23	5.00	2.24
24	6.00	2.68
25	5.00	2.24
26	4.00	1.79
27	4.00	1.79
28	5.00	2.24
29	4.00	1.79
30	7.00	3.13
31	18.00	8.05
2008		6.26
Sep	Avg	
1	18.00	8.05
2	23.00	10.28
3	28.00	12.52

4	14.00	6.26
5	7.00	3.13
6	16.00	7.15
7	26.00	11.62
8	18.00	8.05
9	25.00	11.18
10	14.00	6.26
11	9.00	4.02
12	22.00	9.83
13	29.00	12.96
14	20.00	8.94
15	14.00	6.26
16	5.00	2.24
17	5.00	2.24
18	23.00	10.28
19	11.00	4.92
20	5.00	2.24
21	4.00	1.79
22	3.00	1.34
23	17.00	7.60
24	8.00	3.58
25	7.00	3.13
26	5.00	2.24
27	4.00	1.79
28	5.00	2.24
29	10.00	4.47
30	4.00	1.79
2008		5.95
Oct	Avg	
1	12.00	5.36
2	7.00	3.13
3	4.00	1.79
4	4.00	1.79
5	2.00	0.89
6	3.00	1.34
7	3.00	1.34
8	2.00	0.89
9	25.00	11.18
10	28.00	12.52
11	22.00	9.83
12	9.00	4.02
13	4.00	1.79
14	4.00	1.79
15	6.00	2.68
16	3.00	1.34
17	4.00	1.79
18	21.00	9.39
19	5.00	2.24

20	3.00	1.34
21	6.00	2.68
22	8.00	3.58
23	6.00	2.68
24	7.00	3.13
25	22.00	9.83
26	7.00	3.13
27	6.00	2.68
28	13.00	5.81
29	6.00	2.68
30	20.00	8.94
31	9.00	4.02
2008		4.05
Nov	Avg	
1	4.00	1.79
2	4.00	1.79
3	3.00	1.34
4	2.00	0.89
5	7.00	3.13
6	11.00	4.92
7	3.00	1.34
8	7.00	3.13
9	28.00	12.52
10	21.00	9.39
11	8.00	3.58
12	4.00	1.79
13	14.00	6.26
14	10.00	4.47
15	17.00	7.60
16	20.00	8.94
17	3.00	1.34
18	5.00	2.24
19	5.00	2.24
20	5.00	2.24
21	6.00	2.68
22	4.00	1.79
23	5.00	2.24
24	28.00	12.52
25	13.00	5.81
26	4.00	1.79
27	3.00	1.34
28	2.00	0.89
29	4.00	1.79
30	6.00	2.68
2008		3.81
Dec	Avg	
1	7.00	3.13
2	20.00	8.94

3	35.00	15.65
4	32.00	14.31
5	12.00	5.36
6	3.00	1.34
7	6.00	2.68
8	0.00	0.00
9	3.00	1.34
10	6.00	2.68
11	4.00	1.79
12	10.00	4.47
13	7.00	3.13
14	28.00	12.52
15	21.00	9.39
16	30.00	13.41
17	31.00	13.86
18	30.00	13.41
19	29.00	12.96
20	8.00	3.58
21	11.00	4.92
22	24.00	10.73
23	18.00	8.05
24	7.00	3.13
25	28.00	12.52
26	8.00	3.58
27	6.00	2.68
28	9.00	4.02
29	10.00	4.47
30	9.00	4.02
31	9.00	4.02
2009		6.65
Jan	Avg	
1	7.00	3.13
2	5.00	2.24
3	5.00	2.24
4	7.00	3.13
5	7.00	3.13
6	9.00	4.02
7	10.00	4.47
8	15.00	6.71
9	9.00	4.02
10	13.00	5.81
11	18.00	8.05
12	11.00	4.92
13	28.00	12.52
14	36.00	16.09
15	32.00	14.31
16	30.00	13.41
17	18.00	8.05

18	6.00	2.68
19	11.00	4.92
20	5.00	2.24
21	9.00	4.02
22	31.00	13.86
23	35.00	15.65
24	30.00	13.41
25	18.00	8.05
26	10.00	4.47
27	6.00	2.68
28	4.00	1.79
29	0.00	0.00
30	6.00	2.68
31	3.00	1.34
2009		6.26
Feb	Avg	
1	4.00	1.79
2	0.00	0.00
3	7.00	3.13
4	28.00	12.52
5	30.00	13.41
6	18.00	8.05
7	11.00	4.92
8	5.00	2.24
9	3.00	1.34
10	7.00	3.13
11	30.00	13.41
12	23.00	10.28
13	40.00	17.88
14	26.00	11.62
15	38.00	16.99
16	29.00	12.96
17	6.00	2.68
18	24.00	10.73
19	19.00	8.49
20	9.00	4.02
21	13.00	5.81
22	20.00	8.94
23	10.00	4.47
24	7.00	3.13
25	22.00	9.83
26	15.00	6.71
27	22.00	9.83
28	20.00	8.94
2009		7.76
Mar	Avg	
1	5.00	2.24
2	10.00	4.47

3	16.00	7.15
4	24.00	10.73
5	31.00	13.86
6	14.00	6.26
7	8.00	3.58
8	28.00	12.52
9	30.00	13.41
10	25.00	11.18
11	22.00	9.83
12	0.00	0.00
13	6.00	2.68
14	6.00	2.68
15	8.00	3.58
16	6.00	2.68
17	6.00	2.68
18	6.00	2.68
19	0.00	0.00
20	6.00	2.68
21	4.00	1.79
22	8.00	3.58
23	7.00	3.13
24	5.00	2.24
25	33.00	14.75
26	11.00	4.92
27	5.00	2.24
28	5.00	2.24
30	8.00	3.58
31	11.00	4.92
2009		5.28
Apr	Avg	
1	10.00	4.47
2	16.00	7.15
3	7.00	3.13
4	6.00	2.68
5	14.00	6.26
6	22.00	9.83
7	11.00	4.92
8	0.00	0.00
9	20.00	8.94
10	22.00	9.83
11	0.00	0.00
12	9.00	4.02
13	0.00	0.00
14	9.00	4.02
15	0.00	0.00
16	6.00	2.68
17	0.00	0.00
18	0.00	0.00

19	1.00	0.45
20	8.00	3.58
21	6.00	2.68
22	21.00	9.39
23	24.00	10.73
24	4.00	1.79
25	10.00	4.47
26	30.00	13.41
27	31.00	13.86
28	19.00	8.49
29	26.00	11.62
30	26.00	11.62
2009		5.33
May	Avg	
1	18.00	8.05
2	10.00	4.47
3	6.00	2.68
4	7.00	3.13
5	5.00	2.24
6	6.00	2.68
7	4.00	1.79
8	8.00	3.58
9	8.00	3.58
10	7.00	3.13
11	10.00	4.47
12	6.00	2.68
13	3.00	1.34
14	7.00	3.13
15	6.00	2.68
16	4.00	1.79
17	11.00	4.92
18	24.00	10.73
19	6.00	2.68
20	9.00	4.02
21	8.00	3.58
22	7.00	3.13
23	8.00	3.58
24	8.00	3.58
25	6.00	2.68
26	6.00	2.68
27	6.00	2.68
28	11.00	4.92
29	8.00	3.58
30	19.00	8.49
31	31.00	13.86
2009		4.08
Jun	Avg	
1	25.00	11.18

2	21.00	9.39
3	5.00	2.24
4	18.00	8.05
5	20.00	8.94
6	5.00	2.24
7	5.00	2.24
8	12.00	5.36
9	7.00	3.13
10	5.00	2.24
11	5.00	2.24
12	15.00	6.71
13	11.00	4.92
14	12.00	5.36
15	5.00	2.24
16	6.00	2.68
17	17.00	7.60
18	8.00	3.58
19	6.00	2.68
20	18.00	8.05
21	21.00	9.39
22	17.00	7.60
23	12.00	5.36
24	9.00	4.02
25	10.00	4.47
26	5.00	2.24
27	7.00	3.13
28	6.00	2.68
29	4.00	1.79
30	6.00	2.68
2009		4.81
Jul	Avg	
1	6.00	2.68
2	0.00	0.00
3	9.00	4.02
4	6.00	2.68
5	0.00	0.00
6	6.00	2.68
7	7.00	3.13
8	12.00	5.36
9	5.00	2.24
10	0.00	0.00
11	0.00	0.00
12	0.00	0.00
13	16.00	7.15
14	0.00	0.00
15	4.00	1.79
16	4.00	1.79
17	10.00	4.47

18	18.00	8.05
19	21.00	9.39
20	20.00	8.94
21	13.00	5.81
22	29.00	12.96
23	25.00	11.18
24	21.00	9.39
25	26.00	11.62
26	0.00	0.00
27	0.00	0.00
28		0.00
29		0.00
30		0.00
31		0.00
2009		3.72

Aug	Avg	
1		0.00
2		0.00
3	0.00	0.00
4	27.00	12.07
5	14.00	6.26
6	2.00	0.89
7	0.00	0.00
8	0.00	0.00
9		0.00
10		0.00
11		0.00
12		0.00
13		0.00
14		0.00
15		0.00
16		0.00
17		0.00
18		0.00
19		0.00
20		0.00
21		0.00
22		0.00
23		0.00
24		0.00
25		0.00
26		0.00
27		0.00
28		0.00
29		0.00
30		0.00
31		0.00
2009		0.62

Sep	Avg	
1	17.00	7.60
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
5	8.00	3.58
6	10.00	4.47
7	17.00	7.60
8	13.00	5.81
9	15.00	6.71
10	11.00	4.92
11	15.00	6.71
12	11.00	4.92
14	15.00	6.71
15	11.00	4.92
16	16.00	7.15
17	19.00	8.49
18	12.00	5.36
19	5.00	2.24
20	4.00	1.79
21	4.00	1.79
29	21.00	9.39
30	10.00	4.47
2009		4.75

Oct	Avg	
1	4.00	1.79
2	20.00	8.94
3	30.00	13.41
4	20.00	8.94
5	6.00	2.68
6	13.00	5.81
7	29.00	12.96
8	32.00	14.31
9	32.00	14.31
10	32.00	14.31
11	22.00	9.83
12	6.00	2.68
13	4.00	1.79
14	4.00	1.79
15	2.00	0.89
16	4.00	1.79
17	3.00	1.34
18	4.00	1.79
19	6.00	2.68
20	4.00	1.79
27	1.00	0.45
28	4.00	1.79
29	10.00	4.47

30	11.00	4.92
2009		5.64
Nov	Avg	
1	6.00	2.68
2	8.00	3.58
3	4.00	1.79
4	19.00	8.49
5	0.00	0.00
6	0.00	0.00
7	0.00	0.00
9	18.00	8.05
10	11.00	4.92
11	30.00	13.41
12	12.00	5.36
13	13.00	5.81
14	6.00	2.68
15	3.00	1.34
16	4.00	1.79
17	4.00	1.79
18	4.00	1.79
19	4.00	1.79
20	3.00	1.34
21	2.00	0.89
22	29.00	12.96
23	23.00	10.28
24	17.00	7.60
25	5.00	2.24
27	25.00	11.18
28	4.00	1.79
29	4.00	1.79
30	33.00	14.75
2009		4.65
Dec	Avg	
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
5	0.00	0.00
7	21.00	9.39
8	17.00	7.60
9	18.00	8.05
10	16.00	7.15
11	11.00	4.92
12	9.00	4.02
13	7.00	3.13
14	2.00	0.89
15	1.00	0.45
16	1.00	0.45

17	1.00	0.45
18	0.00	0.00
19	25.00	11.18
20	36.00	16.09
21	38.00	16.99
22	22.00	9.83
23	17.00	7.60
24	15.00	6.71
25	2.00	0.89
26	3.00	1.34
27	7.00	3.13
28	21.00	9.39
29	19.00	8.49
30	22.00	9.83
31	14.00	6.26
2010		5.14
Jan	Avg	
1	4.00	1.79
2	10.00	4.47
3	24.00	10.73
4	28.00	12.52
5	27.00	12.07
6	8.00	3.58
7	4.00	1.79
8	4.00	1.79
9	3.00	1.34
10	3.00	1.34
11	4.00	1.79
12	4.00	1.79
13	2.00	0.89
14	2.00	0.89
15	4.00	1.79
16	4.00	1.79
17	2.00	0.89
18	2.00	0.89
19	2.00	0.89
20	3.00	1.34
21	3.00	1.34
22	0.00	0.00
23	4.00	1.79
24	0.00	0.00
25	0.00	0.00
26	9.00	4.02
27	4.00	1.79
28	5.00	2.24
29	2.00	0.89
30	4.00	1.79
24	5.00	2.24

25	5.00	2.24
26	4.00	1.79
27	4.00	1.79
28	2.00	0.89
2010		2.49
Mar	Avg	
1	3.00	1.34
2	22.00	9.83
3	24.00	10.73
4	12.00	5.36
5	33.00	14.75
6	12.00	5.36
7	7.00	3.13
8	23.00	10.28
9	6.00	2.68
10	5.00	2.24
11	5.00	2.24
12	3.00	1.34
13	7.00	3.13
14	4.00	1.79
15	5.00	2.24
16	7.00	3.13
17	8.00	3.58
18	21.00	9.39
19	14.00	6.26
20	7.00	3.13
21	6.00	2.68
22	5.00	2.24
23	0.00	0.00
24	0.00	0.00
25	0.00	0.00
26	4.00	1.79
27	23.00	10.28
28	16.00	7.15
29	5.00	2.24
30	5.00	2.24
31	8.00	3.58
2010		4.33
Apr	Avg	
1	11.00	4.92
2	13.00	5.81
3	7.00	3.13
4	20.00	8.94
5	22.00	9.83
6	10.00	4.47
7	6.00	2.68
8	6.00	2.68
9	5.00	2.24

10	30.00	13.41
11	33.00	14.75
12	35.00	15.65
13	10.00	4.47
14	6.00	2.68
15	7.00	3.13
16	29.00	12.96
17	23.00	10.28
18	18.00	8.05
19	0.00	0.00
20	18.00	8.05
21	21.00	9.39
22	21.00	9.39
23	21.00	9.39
24	12.00	5.36
25	10.00	4.47
26	10.00	4.47
27	11.00	4.92
28	12.00	5.36
29	19.00	8.49
30	9.00	4.02
2010		6.78

May	Avg	
1	9.00	4.02
2	10.00	4.47
3	7.00	3.13
4	6.00	2.68
5	5.00	2.24
6	4.00	1.79
7	10.00	4.47
8	10.00	4.47
9	8.00	3.58
10	18.00	8.05
11	36.00	16.09
12	19.00	8.49
13	24.00	10.73
14	17.00	7.60
15	18.00	8.05
16	16.00	7.15
17	9.00	4.02
18	7.00	3.13
19	8.00	3.58
20	19.00	8.49
21	6.00	2.68
22	15.00	6.71
23	7.00	3.13
24	7.00	3.13
25	5.00	2.24

26	15.00	6.71
27	10.00	4.47
28	12.00	5.36
29	0.00	0.00
30	11.00	4.92
31	12.00	5.36
2010		5.19
Jun	Avg	
1	14.00	6.26
2	0.00	0.00
3	6.00	2.68
4	17.00	7.60
5	13.00	5.81
6	9.00	4.02
7	4.00	1.79
8	8.00	3.58
9	7.00	3.13
10	15.00	6.71
11	4.00	1.79
12	7.00	3.13
13	8.00	3.58
14	31.00	13.86
15	32.00	14.31
16	23.00	10.28
17	22.00	9.83
18	17.00	7.60
19	11.00	4.92
20	5.00	2.24
21	3.00	1.34
22	8.00	3.58
23	7.00	3.13
24	9.00	4.02
25	10.00	4.47
26	6.00	2.68
27	5.00	2.24
28	5.00	2.24
29	9.00	4.02
30	12.00	5.36
11	8.00	3.58
12	7.00	3.13
13	18.00	8.05
20	17.00	7.60
21	9.00	4.02
22	5.00	2.24
23	5.00	2.24
24	14.00	6.26
25	26.00	11.62
26	19.00	8.49

27	6.00	2.68
28	18.00	8.05
29	22.00	9.83
30	20.00	8.94
31	18.00	8.05
2010		5.35
Aug	Avg	
1	9.00	4.02
2	13.00	5.81
3	12.00	5.36
4	20.00	8.94
5	2.00	0.89
6	10.00	4.47
7	9.00	4.02
8	16.00	7.15
9	30.00	13.41
10	24.00	10.73
11	19.00	8.49
12	7.00	3.13
13	14.00	6.26
14	29.00	12.96
15	24.00	10.73
16	20.00	8.94
17	19.00	8.49
18	7.00	3.13
19	5.00	2.24
20	4.00	1.79
21	10.00	4.47
22	6.00	2.68
23	6.00	2.68
24	4.00	1.79
25	4.00	1.79
26	8.00	3.58
27	15.00	6.71
28	11.00	4.92
29	3.00	1.34
30	4.00	1.79
31	0.00	0.00
2010		5.25
Sep	Avg	
1	5.00	2.24
2	5.00	2.24
3	3.00	1.34
4	29.00	12.96
5	11.00	4.92
6	13.00	5.81
7	28.00	12.52
8	0.00	0.00

9	10.00	4.47
10	4.00	1.79
11	6.00	2.68
12	6.00	2.68
13	0.00	0.00
14	9.00	4.02
16	7.00	3.13
17	7.00	3.13
18	7.00	3.13
19	7.00	3.13
20	15.00	6.71
21	16.00	7.15
22	5.00	2.24
23	6.00	2.68
24	8.00	3.58
25	7.00	3.13
29	3.00	1.34
30	32.00	14.31
2010		4.28
Oct	Avg	
1	0.00	0.00
2	27.00	12.07
3	18.00	8.05
4	22.00	9.83
5	8.00	3.58
6	6.00	2.68
7	4.00	1.79
8	2.00	0.89
9	6.00	2.68
10	4.00	1.79
11	4.00	1.79
12	4.00	1.79
13	5.00	2.24
14	4.00	1.79
15	4.00	1.79
16	19.00	8.49
17	15.00	6.71
18	4.00	1.79
19	0.00	0.00
20	15.00	6.71
21	32.00	14.31
22	10.00	4.47
23	18.00	8.05
24	10.00	4.47
25	0.00	0.00
26	4.00	1.79
27	33.00	14.75
28	22.00	9.83

29	7.00	3.13
30	13.00	5.81
31	16.00	7.15
2010		4.85
Nov	Avg	
1	4.00	1.79
2	12.00	5.36
3	10.00	4.47
4	5.00	2.24
5	6.00	2.68
6	8.00	3.58
8	3.00	1.34
9	2.00	0.89
10	18.00	8.05
11	4.00	1.79
12	8.00	3.58
13	6.00	2.68
14	5.00	2.24
15	6.00	2.68
16	7.00	3.13
17	14.00	6.26
18	7.00	3.13
19	17.00	7.60
20	1.00	0.45
21	14.00	6.26
22	29.00	12.96
23	32.00	14.31
24	20.00	8.94
25	7.00	3.13
26	6.00	2.68
27	2.00	0.89
28	5.00	2.24
29	8.00	3.58
30	6.00	2.68
2010		4.19
Dec	Avg	
1	10.00	4.47
2	12.00	5.36
3	35.00	15.65
4	5.00	2.24
5	2.00	0.89
6	2.00	0.89
7	1.00	0.45
8	1.00	0.45
9	0.00	0.00
10	0.00	0.00
11	1.00	0.45
13	0.00	0.00

14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	9.00	4.02
20	6.00	2.68
21	5.00	2.24
22	6.00	2.68
23	6.00	2.68
24	6.00	2.68
25	7.00	3.13
26	6.00	2.68
27	6.00	2.68
28	6.00	2.68
29	3.00	1.34
30	20.00	8.94
31	18.00	8.05
2011		2.58
Jan	Avg	
1	12.00	5.36
3	35.00	15.65
4	26.00	11.62
5	11.00	4.92
6	4.00	1.79
7	9.00	4.02
8	0.00	0.00
9	13.00	5.81
10	8.00	3.58
11	6.00	2.68
12	4.00	1.79
13	5.00	2.24
14	9.00	4.02
15	5.00	2.24
16	11.00	4.92
17	19.00	8.49
18	10.00	4.47
19	21.00	9.39
20	4.00	1.79
21	3.00	1.34
22	6.00	2.68
23	6.00	2.68
24	5.00	2.24
25	0.00	0.00
26	4.00	1.79
27	11.00	4.92
28	30.00	13.41
29	35.00	15.65

30	0.00	0.00
31	32.00	14.31
2011		5.13
Feb	Avg	
1	12.00	5.36
2	5.00	2.24
3	0.00	0.00
4	4.00	1.79
5	22.00	9.83
6	21.00	9.39
7	23.00	10.28
8	41.00	18.33
9	13.00	5.81
10	6.00	2.68
11	7.00	3.13
12	4.00	1.79
13	6.00	2.68
14	6.00	2.68
15	10.00	4.47
16	8.00	3.58
17	35.00	15.65
18	16.00	7.15
19	12.00	5.36
20	27.00	12.07
21	13.00	5.81
22	0.00	0.00
23	30.00	13.41
24	39.00	17.43
25	33.00	14.75
26	19.00	8.49
28	11.00	4.92
2011		7.00
Mar	Avg	
1	8.00	3.58
2	1.00	0.45
3	4.00	1.79
4	10.00	4.47
5	8.00	3.58
6	27.00	12.07
9	8.00	3.58
10	0.00	0.00
12	10.00	4.47
13	9.00	4.02
14	11.00	4.92
15	8.00	3.58
16	0.00	0.00
17	7.00	3.13
18	24.00	10.73

19	19.00	8.49
20	36.00	16.09
21	0.00	0.00
22	0.00	0.00
24	12.00	5.36
28	7.00	3.13
29	23.00	10.28
30	4.00	1.79
31	9.00	4.02
2011		4.56
Apr	Avg	
1	14.00	6.26
2	25.00	11.18
3	29.00	12.96
4	19.00	8.49
5	18.00	8.05
6	12.00	5.36
7	38.00	16.99
16	7.00	3.13
18	14.00	6.26
19	16.00	7.15
20	18.00	8.05
21	13.00	5.81
22	17.00	7.60
23	17.00	7.60
24	15.00	6.71
25	15.00	6.71
26	7.00	3.13
27	10.00	4.47
28	15.00	6.71
29	10.00	4.47
30	5.00	2.24
31	26.00	11.62
2011		7.32
Jun	Avg	
1	17.00	7.60
2	6.00	2.68
3	25.00	11.18
4	20.00	8.94
5	11.00	4.92
6	5.00	2.24
7	17.00	7.60
8	13.00	5.81
9	6.00	2.68
10	11.00	4.92
11	15.00	6.71
12	12.00	5.36
13	12.00	5.36

14	9.00	4.02
15	6.00	2.68
16	7.00	3.13
17	5.00	2.24
18	8.00	3.58
19	6.00	2.68
20	12.00	5.36
21	0.00	0.00
22	6.00	2.68
23	4.00	1.79
24	7.00	3.13
25	11.00	4.92
26	0.00	0.00
27	16.00	7.15
28	7.00	3.13
29	6.00	2.68
30	4.00	1.79
2011		4.23
Jul	Avg	
1	4.00	1.79
2	4.00	1.79
3	7.00	3.13
4	12.00	5.36
5	6.00	2.68
6	10.00	4.47
7	13.00	5.81
8	14.00	6.26
9	20.00	8.94
10	13.00	5.81
11	27.00	12.07
12	16.00	7.15
13	4.00	1.79
14	6.00	2.68
15	6.00	2.68
16	5.00	2.24
17	15.00	6.71
18	5.00	2.24
19	5.00	2.24
20	12.00	5.36
21	8.00	3.58
22	6.00	2.68
23	27.00	12.07
24	20.00	8.94
25	10.00	4.47
26	7.00	3.13
27	8.00	3.58
28	4.00	1.79
29	4.00	1.79

30	5.00	2.24
31	4.00	1.79
2011		4.43
Aug	Avg	
1	24.00	10.73
2	26.00	11.62
3	25.00	11.18
4	26.00	11.62
5	11.00	4.92
6	22.00	9.83
7	14.00	6.26
8	13.00	5.81
9	10.00	4.47
10	5.00	2.24
11	4.00	1.79
12	7.00	3.13
13	6.00	2.68
14	6.00	2.68
15	6.00	2.68
16	4.00	1.79
17	8.00	3.58
18	16.00	7.15
19	19.00	8.49
20	15.00	6.71
21	11.00	4.92
22	10.00	4.47
23	11.00	4.92
24	13.00	5.81
25	21.00	9.39
26	7.00	3.13
27	19.00	8.49
28	9.00	4.02
29	11.00	4.92
30	15.00	6.71
31	15.00	6.71
2011		5.90
Sep	Avg	
1	6.00	2.68
2	13.00	5.81
3	20.00	8.94
4	18.00	8.05
5	10.00	4.47
6	20.00	8.94
7	33.00	14.75
8	22.00	9.83
9	8.00	3.58
10	5.00	2.24
11	9.00	4.02

12	19.00	8.49
13	25.00	11.18
14	21.00	9.39
15	25.00	11.18
16	12.00	5.36
17	14.00	6.26
18	0.00	0.00
19	17.00	7.60
20	22.00	9.83
21	17.00	7.60
22	12.00	5.36
23	5.00	2.24
24	8.00	3.58
25	7.00	3.13
26	6.00	2.68
27	3.00	1.34
28	4.00	1.79
29	2.00	0.89
30	2.00	0.89
2011		5.74
Oct	Avg	
1	8.00	3.58
2	30.00	13.41
3	14.00	6.26
4	4.00	1.79
5	17.00	7.60
6	23.00	10.28
7	7.00	3.13
8	5.00	2.24
9	4.00	1.79
10	6.00	2.68
11	5.00	2.24
12	6.00	2.68
13	28.00	12.52
14	37.00	16.54
15	17.00	7.60
16	4.00	1.79
17	3.00	1.34
18	5.00	2.24
19	5.00	2.24
20	23.00	10.28
21	17.00	7.60
22	13.00	5.81
23	14.00	6.26
24	30.00	13.41
25	29.00	12.96
26	4.00	1.79
27	20.00	8.94

28	17.00	7.60
29	4.00	1.79
30	5.00	2.24
31	10.00	4.47
2011		5.97
Nov	Avg	
1	0.00	0.00
2	0.00	0.00
3	11.00	4.92
4	0.00	0.00
5	0.00	0.00
6	0.00	0.00
7	0.00	0.00
8	0.00	0.00
9	0.00	0.00
10	8.00	3.58
11	22.00	9.83
12	11.00	4.92
13	8.00	3.58
14	4.00	1.79
15	5.00	2.24
16	6.00	2.68
17	6.00	2.68
18	6.00	2.68
19	17.00	7.60
20	7.00	3.13
21	5.00	2.24
22	5.00	2.24
23	8.00	3.58
24	7.00	3.13
25	5.00	2.24
26	5.00	2.24
27	14.00	6.26
28	5.00	2.24
29	9.00	4.02
30	34.00	15.20
2011		3.10
Dec	Avg	
1	18.00	8.05
2	14.00	6.26
3	44.00	19.67
4	16.00	7.15
5	0.00	0.00
6	8.00	3.58
7	41.00	18.33
8	23.00	10.28
9	11.00	4.92
10	18.00	8.05

11	22.00	9.83
12	9.00	4.02
13	14.00	6.26
14	10.00	4.47
15	15.00	6.71
16	28.00	12.52
17	32.00	14.31
18	33.00	14.75
19	14.00	6.26
20	17.00	7.60
21	21.00	9.39
22	5.00	2.24
24	4.00	1.79
25	2.00	0.89
26	5.00	2.24
27	3.00	1.34
28	4.00	1.79
29	3.00	1.34
30	4.00	1.79
31	4.00	1.79
2012		6.59
Jan	Avg	
1	7.00	3.13
2	6.00	2.68
3	6.00	2.68
4	4.00	1.79
5	0.00	0.00
6	5.00	2.24
7	8.00	3.58
8	6.00	2.68
9	18.00	8.05
10	41.00	18.33
11	19.00	8.49
12	8.00	3.58
13	6.00	2.68
14	11.00	4.92
15	12.00	5.36
16	5.00	2.24
17	10.00	4.47
18	13.00	5.81
19	9.00	4.02
20	7.00	3.13
21	8.00	3.58
22	6.00	2.68
23	6.00	2.68
24	0.00	0.00
25	0.00	0.00
26	0.00	0.00

27	0.00	0.00
28	0.00	0.00
29	8.00	3.58
30	0.00	0.00
31	0.00	0.00
2012		3.30
Feb	Avg	
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
5	0.00	0.00
6	34.00	15.20
7	28.00	12.52
8	26.00	11.62
9	28.00	12.52
10	19.00	8.49
11	29.00	12.96
14	2.00	0.89
15	35.00	15.65
16	31.00	13.86
19	21.00	9.39
20	14.00	6.26
21	4.00	1.79
22	10.00	4.47
23	10.00	4.47
24	4.00	1.79
25	4.00	1.79
26	14.00	6.26
27	11.00	4.92
28	5.00	2.24
29	4.00	1.79
2012		5.95
Mar	Avg	
1	4.00	1.79
2	6.00	2.68
3	0.00	0.00
4	5.00	2.24
5	9.00	4.02
6	19.00	8.49
7	0.00	0.00
8	14.00	6.26
9	3.00	1.34
10	4.00	1.79
11	4.00	1.79
12	5.00	2.24
13	3.00	1.34
14	1.00	0.45

17	5.00	2.24
18	5.00	2.24
19	3.00	1.34
20	5.00	2.24
21	5.00	2.24
22	0.00	0.00
23	10.00	4.47
24	11.00	4.92
25	5.00	2.24
26	18.00	8.05
27	28.00	12.52
28	21.00	9.39
29	9.00	4.02
30	3.00	1.34
31	3.00	1.34
2012		3.21
Apr	Avg	
1	6.00	2.68
2	7.00	3.13
3	4.00	1.79
4	22.00	9.83
5	37.00	16.54
6	5.00	2.24
7	3.00	1.34
8	18.00	8.05
9	20.00	8.94
10	18.00	8.05
11	6.00	2.68
12	5.00	2.24
13	4.00	1.79
8	19.00	8.49
8	5.00	2.24
9	4.00	1.79
10	5.00	2.24
11	4.00	1.79
12	6.00	2.68
13	5.00	2.24
14	4.00	1.79
15	5.00	2.24
16	5.00	2.24
17	3.00	1.34
18	4.00	1.79
19	6.00	2.68
20	4.00	1.79
21	7.00	3.13
22	7.00	3.13
23	5.00	2.24
24	5.00	2.24

25	7.00	3.13
26	6.00	2.68
27	6.00	2.68
28	6.00	2.68
29	6.00	2.68
30	8.00	3.58
31	12.00	5.36
2012		3.64
Nov	Avg	
1	8.00	3.58
2	6.00	2.68
3	4.00	1.79
4	5.00	2.24
5	6.00	2.68
6	7.00	3.13
7	8.00	3.58
8	24.00	10.73
9	30.00	13.41
10	15.00	6.71
11	6.00	2.68
12	0.00	0.00
13	11.00	4.92
14	7.00	3.13
15	8.00	3.58
16	6.00	2.68
17	7.00	3.13
18	5.00	2.24
19	7.00	3.13
20	8.00	3.58
21	8.00	3.58
22	6.00	2.68
23	8.00	3.58
24	7.00	3.13
25	9.00	4.02
26	18.00	8.05
14	9.00	4.02
15	9.00	4.02
16	10.00	4.47
23	2.00	0.89
24	7.00	3.13
25	7.00	3.13
26	5.00	2.24
27	6.00	2.68
28	19.00	8.49
29	17.00	7.60
30	30.00	13.41
31	4.00	1.79
2013		4.22

Feb	Avg	
1	4.00	1.79
2	10.00	4.47
3	10.00	4.47
4	12.00	5.36
5	5.00	2.24
6	3.00	1.34
7	24.00	10.73
8	12.00	5.36
9	27.00	12.07
10	20.00	8.94
11	4.00	1.79
12	24.00	10.73
13	30.00	13.41
14	19.00	8.49
15	7.00	3.13
16	5.00	2.24
17	6.00	2.68
18	5.00	2.24
19	5.00	2.24
20	5.00	2.24
21	5.00	2.24
22	6.00	2.68
23	6.00	2.68
24	9.00	4.02
25	22.00	9.83
26	13.00	5.81
27	26.00	11.62
28	15.00	6.71
2013		5.41

Mar	Avg	
1	5.00	2.24
2	3.00	1.34
3	24.00	10.73
4	24.00	10.73
5	19.00	8.49
6	21.00	9.39
7	40.00	17.88
8	28.00	12.52
9	18.00	8.05
10	3.00	1.34
11	6.00	2.68
12	5.00	2.24
13	7.00	3.13
14	10.00	4.47
15	3.00	1.34
16	9.00	4.02
17	5.00	2.24

18	7.00	3.13
19	6.00	2.68
20	3.00	1.34
21	19.00	8.49
22	30.00	13.41
23	6.00	2.68
24	7.00	3.13
25	7.00	3.13
26	5.00	2.24
27	20.00	8.94
28	30.00	13.41
29	31.00	13.86
30	14.00	6.26
31	10.00	4.47
2013		6.13
Apr	Avg	
1	6.00	2.68
2	6.00	2.68
3	5.00	2.24
4	6.00	2.68
5	8.00	3.58
6	6.00	2.68
7	6.00	2.68
8	5.00	2.24
9	6.00	2.68
10	4.00	1.79
11	7.00	3.13
12	7.00	3.13
13	6.00	2.68
14	9.00	4.02
15	7.00	3.13
16	7.00	3.13
17	8.00	3.58
18	8.00	3.58
19	6.00	2.68
20	18.00	8.05
21	14.00	6.26
22	19.00	8.49
23	20.00	8.94
24	11.00	4.92
25	11.00	4.92
26	7.00	3.13
27	8.00	3.58
28	7.00	3.13
29	5.00	2.24
30	9.00	4.02
2013		3.76
May	Avg	

1	5.00	2.24
2	4.00	1.79
3	5.00	2.24
4	6.00	2.68
5	6.00	2.68
6	8.00	3.58
7	9.00	4.02
8	10.00	4.47
9	17.00	7.60
10	8.00	3.58
11	7.00	3.13
12	6.00	2.68
13	8.00	3.58
14	4.00	1.79
15	15.00	6.71
16	21.00	9.39
17	9.00	4.02
18	10.00	4.47
19	4.00	1.79
20	20.00	8.94
21	21.00	9.39
22	19.00	8.49
23	8.00	3.58
24	5.00	2.24
25	14.00	6.26
26	17.00	7.60
27	16.00	7.15
28	10.00	4.47
29	10.00	4.47
30	14.00	6.26
31	12.00	5.36
2013		4.73
Jun	Avg	
1	9.00	4.02
2	21.00	9.39
3	19.00	8.49
4	15.00	6.71
5	18.00	8.05
6	10.00	4.47
7	5.00	2.24
8	5.00	2.24
9	7.00	3.13
10	6.00	2.68
11	5.00	2.24
12	6.00	2.68
13	4.00	1.79
14	8.00	3.58
15	10.00	4.47

16	8.00	3.58
17	7.00	3.13
18	4.00	1.79
19	16.00	7.15
20	15.00	6.71
22	20.00	8.94
23	13.00	5.81
24	5.00	2.24
25	8.00	3.58
26	7.00	3.13
27	11.00	4.92
28	6.00	2.68
29	8.00	3.58
30	31.00	13.86
2013		4.73
Jul	Avg	
1	25.00	11.18
2	21.00	9.39
3	22.00	9.83
4	24.00	10.73
5	14.00	6.26
6	25.00	11.18
7	21.00	9.39
8	10.00	4.47
9	7.00	3.13
10	6.00	2.68
11	4.00	1.79
12	6.00	2.68
13	7.00	3.13
14	13.00	5.81
15	13.00	5.81
16	4.00	1.79
17	2.00	0.89
18	6.00	2.68
19	7.00	3.13
20	9.00	4.02
21	5.00	2.24
22	4.00	1.79
23	5.00	2.24
24	6.00	2.68
25	4.00	1.79
26	7.00	3.13
27	8.00	3.58
28	9.00	4.02
29	5.00	2.24
30	3.00	1.34
31	8.00	3.58
2013		4.47

Aug	Avg	
1	16.00	7.15
2	16.00	7.15
3	27.00	12.07
4	23.00	10.28
5	18.00	8.05
6	18.00	8.05
7	17.00	7.60
8	23.00	10.28
9	21.00	9.39
10	20.00	8.94
11	11.00	4.92
12	4.00	1.79
13	6.00	2.68
14	6.00	2.68
15	3.00	1.34
16	10.00	4.47
17	10.00	4.47
18	4.00	1.79
19	10.00	4.47
20	5.00	2.24
21	13.00	5.81
22	17.00	7.60
23	11.00	4.92
24	7.00	3.13
25	6.00	2.68
26	5.00	2.24
27	10.00	4.47
28	9.00	4.02
29	4.00	1.79
30	4.00	1.79
31	2.00	0.89
2013		5.13

Sep	Avg	
1	12.00	5.36
2	35.00	15.65
3	28.00	12.52
4	22.00	9.83
5	23.00	10.28
6	16.00	7.15
7	12.00	5.36
8	5.00	2.24
9	28.00	12.52
10	28.00	12.52
11	8.00	3.58
12	26.00	11.62
13	21.00	9.39
14	5.00	2.24

15	6.00	2.68
16	7.00	3.13
17	5.00	2.24
18	4.00	1.79
19	4.00	1.79
20	4.00	1.79
21	5.00	2.24
22	7.00	3.13
23	4.00	1.79
24	21.00	9.39
25	27.00	12.07
26	5.00	2.24
27	13.00	5.81
28	5.00	2.24
29	7.00	3.13
30	6.00	2.68
2013		5.95
Oct	Avg	
1	3.00	1.34
2	3.00	1.34
3	8.00	3.58
4	4.00	1.79
5	20.00	8.94
6	13.00	5.81
7	12.00	5.36
8	34.00	15.20
9	6.00	2.68
10	20.00	8.94
11	24.00	10.73
12	37.00	16.54
13	28.00	12.52
14	23.00	10.28
15	40.00	17.88
16	36.00	16.09
17	34.00	15.20
18	34.00	15.20
19	33.00	14.75
20	30.00	13.41
21	24.00	10.73
22	9.00	4.02
23	5.00	2.24
24	23.00	10.28
25	18.00	8.05
26	15.00	6.71
27	33.00	14.75
28	26.00	11.62
29	8.00	3.58
30	11.00	4.92

31	4.00	1.79
2013		8.91
Nov	Avg	
1	3.00	1.34
2	14.00	6.26
3	31.00	13.86
4	12.00	5.36
5	9.00	4.02
6	7.00	3.13
7	22.00	9.83
8	13.00	5.81
9	39.00	17.43
10	13.00	5.81
11	5.00	2.24
12	14.00	6.26
13	37.00	16.54
14	13.00	5.81
15	6.00	2.68
16	13.00	5.81
17	8.00	3.58
18	6.00	2.68
19	14.00	6.26
20	14.00	6.26
21	23.00	10.28
22	6.00	2.68
23	16.00	7.15
24	0.00	0.00
25	3.00	1.34
26	0.00	0.00
27	0.00	0.00
28	5.00	2.24
29	4.00	1.79
30	6.00	2.68
2013		5.30
Dec	Avg	
1	12.00	5.36
2	24.00	10.73
3	22.00	9.83
4	21.00	9.39
5	28.00	12.52
6	0.00	0.00
7	24.00	10.73
8	20.00	8.94
9	17.00	7.60
10	6.00	2.68
11	13.00	5.81
12	11.00	4.92
13	5.00	2.24

14	6.00	2.68
15	4.00	1.79
16	9.00	4.02
17	12.00	5.36
18	25.00	11.18
19	10.00	4.47
20	6.00	2.68
21	10.00	4.47
22	11.00	4.92
23	6.00	2.68
24	19.00	8.49
25	11.00	4.92
26	8.00	3.58
27	6.00	2.68
28	3.00	1.34
29	4.00	1.79
30	3.00	1.34
31	3.00	1.34
2014		5.18
Jan	Avg	
1	17.00	7.60
2	4.00	1.79
3	17.00	7.60
4	8.00	3.58
5	10.00	4.47
6	28.00	12.52
8	6.00	2.68
9	5.00	2.24
10	4.00	1.79
11	0.00	0.00
12	6.00	2.68
13	10.00	4.47
14	0.00	0.00
15	5.00	2.24
16	8.00	3.58
17	0.00	0.00
18	17.00	7.60
19	5.00	2.24
20	29.00	12.96
21	24.00	10.73
22	0.00	0.00
23	0.00	0.00
24	0.00	0.00
25	0.00	0.00
26	26.00	11.62
27	20.00	8.94
28	17.00	7.60
29	15.00	6.71

30	17.00	7.60
31	15.00	6.71
2014		4.66
Feb	Avg	
1	11.00	4.92
2	5.00	2.24
3	19.00	8.49
4	25.00	11.18
5	12.00	5.36
6	10.00	4.47
7	7.00	3.13
8	7.00	3.13
9	4.00	1.79
10	6.00	2.68
11	5.00	2.24
12	4.00	1.79
13	5.00	2.24
14	6.00	2.68
15	6.00	2.68
16	3.00	1.34
17	4.00	1.79
18	3.00	1.34
19	4.00	1.79
20	4.00	1.79
21	21.00	9.39
22	35.00	15.65
25	0.00	0.00
26	27.00	12.07
27	13.00	5.81
28	11.00	4.92
2014		4.42
Mar	Avg	
1	6.00	2.68
2	7.00	3.13
3	5.00	2.24
4	4.00	1.79
5	5.00	2.24
6	4.00	1.79
7	6.00	2.68
8	7.00	3.13
9	4.00	1.79
10	4.00	1.79
11	28.00	12.52
12	30.00	13.41
13	32.00	14.31
14	20.00	8.94
15	12.00	5.36
16	23.00	10.28

17	28.00	12.52
18	10.00	4.47
19	9.00	4.02
20	6.00	2.68
21	10.00	4.47
22	11.00	4.92
23	19.00	8.49
24	12.00	5.36
25	7.00	3.13
26	9.00	4.02
27	8.00	3.58
28	12.00	5.36
29	10.00	4.47
30	8.00	3.58
31	7.00	3.13
2014		5.23
Apr	Avg	
1	8.00	3.58
2	9.00	4.02
3	19.00	8.49
4	22.00	9.83
5	17.00	7.60
6	7.00	3.13
7	7.00	3.13
8	8.00	3.58
9	4.00	1.79
10	11.00	4.92
11	19.00	8.49
12	32.00	14.31
13	30.00	13.41
14	12.00	5.36
15	14.00	6.26
16	13.00	5.81
17	7.00	3.13
18	16.00	7.15
19	10.00	4.47
20	8.00	3.58
21	12.00	5.36
22	10.00	4.47
23	8.00	3.58
24	8.00	3.58
25	22.00	9.83
26	15.00	6.71
27	11.00	4.92
28	17.00	7.60
29	15.00	6.71
30	11.00	4.92
2014		5.99

May	Avg	
1	10.00	4.47
2	9.00	4.02
3	15.00	6.71
4	11.00	4.92
5	5.00	2.24
6	16.00	7.15
13	14.00	6.26
14	4.00	1.79
15	11.00	4.92
16	10.00	4.47
17	8.00	3.58
18	8.00	3.58
19	8.00	3.58
20	6.00	2.68
21	5.00	2.24
22	6.00	2.68
23	6.00	2.68
24	7.00	3.13
25	11.00	4.92
26	16.00	7.15
27	25.00	11.18
28	27.00	12.07
29	29.00	12.96
30	28.00	12.52
31	27.00	12.07
2014		5.81

Jun	Avg	
1	18.00	8.05
2	9.00	4.02
3	4.00	1.79
4	8.00	3.58
5	10.00	4.47
6	14.00	6.26
7	17.00	7.60
8	11.00	4.92
9	12.00	5.36
10	14.00	6.26
11	4.00	1.79
12	11.00	4.92
13	10.00	4.47
14	8.00	3.58
15	7.00	3.13
16	19.00	8.49
17	17.00	7.60
18	16.00	7.15
19	10.00	4.47
20	6.00	2.68

21	14.00	6.26
22	24.00	10.73
23	10.00	4.47
24	4.00	1.79
25	6.00	2.68
26	27.00	12.07
27	22.00	9.83
28	10.00	4.47
29	13.00	5.81
30	4.00	1.79
2014		5.35
Jul	Avg	
1	9.00	4.02
2	14.00	6.26
3	7.00	3.13
4	7.00	3.13
5	6.00	2.68
6	11.00	4.92
7	16.00	7.15
8	5.00	2.24
9	18.00	8.05
10	21.00	9.39
11	24.00	10.73
12	18.00	8.05
13	15.00	6.71
14	16.00	7.15
15	10.00	4.47
16	9.00	4.02
17	13.00	5.81
18	9.00	4.02
19	7.00	3.13
20	4.00	1.79
21	6.00	2.68
22	11.00	4.92
23	9.00	4.02
24	4.00	1.79
25	7.00	3.13
26	5.00	2.24
27	5.00	2.24
28	5.00	2.24
29	7.00	3.13
30	5.00	2.24
31	19.00	8.49
2014		4.64
Aug	Avg	
1	24.00	10.73
2	19.00	8.49
3	14.00	6.26

4	9.00	4.02
5	12.00	5.36
6	18.00	8.05
7	22.00	9.83
8	26.00	11.62
9	22.00	9.83
10	11.00	4.92
11	18.00	8.05
12	23.00	10.28
13	24.00	10.73
14	19.00	8.49
15	19.00	8.49
16	31.00	13.86
17	19.00	8.49
18	6.00	2.68
19	4.00	1.79
20	4.00	1.79
21	4.00	1.79
22	5.00	2.24
23	7.00	3.13
24	15.00	6.71
25	11.00	4.92
26	9.00	4.02
27	15.00	6.71
28	20.00	8.94
29	9.00	4.02
30	4.00	1.79
31	3.00	1.34
2014		6.43
Sep	Avg	
1	17.00	7.60
2	12.00	5.36
3	3.00	1.34
4	13.00	5.81
5	4.00	1.79
6	6.00	2.68
7	4.00	1.79
8	18.00	8.05
9	26.00	11.62
10	23.00	10.28
11	20.00	8.94
12	38.00	16.99
13	25.00	11.18
14	17.00	7.60
15	19.00	8.49
16	21.00	9.39
17	25.00	11.18
18	14.00	6.26

19	3.00	1.34
20	12.00	5.36
21	5.00	2.24
22	5.00	2.24
23	7.00	3.13
24	3.00	1.34
25	5.00	2.24
26	9.00	4.02
27	4.00	1.79
28	4.00	1.79
29	6.00	2.68
30	12.00	5.36
2014		5.66
Oct	Avg	
1	7.00	3.13
2	5.00	2.24
3	9.00	4.02
4	4.00	1.79
5	9.00	4.02
6	8.00	3.58
7	3.00	1.34
8	3.00	1.34
9	12.00	5.36
10	4.00	1.79
11	4.00	1.79
12	5.00	2.24
13	4.00	1.79
14	4.00	1.79
15	0.00	
16	1.00	0.45
17	2.00	0.89
18	2.00	0.89
19	2.00	0.89
20	7.00	3.13
21	5.00	2.24
22	0.00	
23	0.00	
24	3.00	1.34
25	9.00	4.02
26	14.00	6.26
27	26.00	11.62
28	7.00	3.13
29	4.00	1.79
30	5.00	2.24
31	6.00	2.68
2014		2.78
Nov	Avg	
1	5.00	2.24

2	5.00	2.24
3	4.00	1.79
4	2.00	0.89
5	6.00	2.68
6	5.00	2.24
7	15.00	6.71
8	26.00	11.62
9	38.00	16.99
10	25.00	11.18
11	30.00	13.41
12	30.00	13.41
13	23.00	10.28
14	25.00	11.18
15	27.00	12.07
16	26.00	11.62
17	26.00	11.62
18	18.00	8.05
19	28.00	12.52
20	21.00	9.39
21	4.00	1.79
22	5.00	2.24
23	2.00	0.89
24	9.00	4.02
25	4.00	1.79
26	4.00	1.79
27	18.00	8.05
28	21.00	9.39
29	11.00	4.92
30	13.00	5.81
2014		7.09
Dec	Avg	
1	30.00	13.41
2	22.00	9.83
3	16.00	7.15
4	20.00	8.94
5	2.00	0.89
6	1.00	0.45
7	2.00	0.89
8	1.00	0.45
9	1.00	0.45
10	1.00	0.45
11	1.00	0.45
12	1.00	0.45
13	6.00	2.68
14	19.00	8.49
15	25.00	11.18
16	18.00	8.05
17	2.00	0.89